POSITIONS AND INTENSITIES IN THE $2\nu_4/\nu_1/\nu_3$ VIBRATIONAL SYSTEM OF $^{14}NH_3$ NEAR 3 μm

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Abstract

Line positions and line intensities of the ν_1, ν_3 and $2\nu_4$ bands of $^{14}NH_3$ were analyzed using line positions from 0.0054 cm^{-1} apodized resolution FT spectra recorded at Orsay and using line intensities from 0.011 cm^{-1} unapodized resolution FT spectra recorded at Kitt peak National Observatory.

About 2110 lines with $J' \leq 10$ were assigned from which 1832 lines positions are fitted using an effective rotation-inversion Hamiltonian to achieve a rms of 0.085 cm^{-1}. Nearly 1000 line intensity were measured with accuracy of 6% or better and modelled to 11 terms of dipole moment expansion to ± 9.4 %. The band strengths of the ν_1, ν_3 and $2\nu_4$ bands (determined for the first time in the case of the $2\nu_4$ band) are, respectively, 23.6 (2), 11.8 (1) and 2.82 (4) cm^{-2}/atm at 296 K. A prediction of the line positions and intensities was generated for some ~2700 lines with intensities calculated greater than 1×10^{-4} cm^{-2} atm^{-1} at 296 K, suitable for planetological purposes. Tentative assignments involving 22 upper state levels of $4\nu_2^s$ were identified but these were not included into the modelling at the present stage.

The theoretical model and the set of programs developed for treating the infrared system $\nu_1/\nu_3/2\nu_4$ of ammonia are briefly discussed.

I. INTRODUCTION

Ammonia is the fourth most abundant constituent in the atmosphere of Jupiter, after hydrogen, helium and methane [1]. Previously the 3 μm spectral region was rarely used for jovian remote sensing because the telluric absorptions of water vapor and carbon dioxide overwhelmed the planetary signal reaching the ground-based observatories. However, in 1996 the NIMS experiment (Near Infrared Mapping Spectrometer) [2] on Galileo spacecraft and the SWS (Short Wavelength Spectrometer) of the ISO [3] satellite in earth orbit both recorded extensive and interesting spectra involving the features of ammonia at 3330 cm^{-1}. The present study of ammonia line positions and intensities was then undertaken to provide a detailed database of molecular parameters in the 3100 to 3700 cm^{-1} region for the analysis of the spacecraft data.

In this spectral range the observed ammonia absorption arises mainly from the $\nu_1(A_1)$, ν_3 (E) and $2\nu_4$ (A_1+E) vibrational bands. Two much weaker bands $4\nu_2^s$ (A_1) and $(2\nu_2+\nu_4)^{s,a}$ (E) are also present in this range, but these bands do not contribute significantly to the absorption. Nevertheless, we will see that they are of importance in some perturbations observed within the three stronger bands. In spite of a number of works [4-11], only relatively uncomplete spectroscopic data of this spectral range were available for planetary analyses. Guelachvili et al. [8] remeasured a Fourier transform spectrum of the 3 μm region of NH_3 with a 0.0054 cm^{-1} resolution and reported about 1400 assignments in $2\nu_4$, ν_1 and ν_3, but they were unable to introduce in a satisfactory way the most important interactions within those bands, especially between $2\nu_4$ and ν_1. For the intensities, Pine and Dang-Nhu [9] recently determined the band strengths of the fundamentals using about 78 transitions in ν_1 and 21 transitions in ν_3. No measurements of $2\nu_4$ intensities were reported previously.

As in our prior work of the 4 μm region of ammonia [12], the objective of the present effort was to model both positions and intensities as accurately as possible. For the analysis of the line positions, the present study used the spectra recorded with the Fourier transform spectrometer at the Laboratoire de Physique Moléculaire et Applications of Université de Paris Sud [8]. For the line intensities, we averaged measurements from sixteen different 0.011 cm^{-1} resolution spectra of NH_3 recorded from 1800 to 5400 cm^{-1} by the second author with the McMath Fourier transform spectrometer located at Kitt Peak National Observatory [12, 13].

The reported assignments [8] were confirmed and extended up to J' equal 10 in the two fundamentals $\nu_1$and ν_3 and the overtone $2\nu_4$. The measured positions and intensities were then modelled as the triad system of $\nu_1/\nu_3/2\nu_4$ to account properly for the Fermi and Coriolis-type resonances between the three bands. The results of the analysis was then used to produce a line-by-line prediction of the three bands of NH_3 which greatly advances the molecular database at 3 μm and is sufficiently accurate for the spacecraft applications.

A small portion of the much weaker $4\nu_2^s$ band was assigned around 3462 cm^{-1}, but the number of identified levels was too few to be included in the present analysis. No transitions of the fifth band $2\nu_2+\nu_4$ were found despite an extensive search probably because of the weakness of this band. In fact, because of these missing states the data could not be reproduced within experimental uncertainties.

II. EXPERIMENTAL DETAILS

a) Line Position Data

Line positions used in the present work were retrieved exclusively from the data previously recorded with the Fourier transform spectrometer at Laboratoire de Physique Moléculaire et Applications of Université de Paris Sud under a resolution of about

0.0054 cm^{-1}. The measurements were obtained with a 1-m multipass White-type absorption cell using optical path lengths and pressures listed in Table 1.a. Spectra (n° = 1709, 1733) already published [8] were also used. Fmin and Fmax in Table 1 give the lower ad higher limits of the spectrum intervals. All spectra were calibrated using the CO fundamental band calculated from [14] or the CO overtone band [15]. The line positions were then obtained by averaging profiles of similar optical densities. The absolute accuracy of the wavenumbers of isolated lines was estimated to be better than 0.0004 cm^{-1}.

b) Line Intensity Data

Line intensities were obtained from spectra at 0.011 cm^{-1} resolution recorded with the McMath Fourier transform spectrometer located at Kitt Peak National Observatory/National Solar Observatory. The experimental setups were very similar to those used for other ammonia measurements [12,16] in terms of detectors (InSb), beamsplitters (CaF_2), source (globar), pressure gauges (Baratron capacitance manometers) and integration times. Sample pressures were selected to maintain a stable sample of ammonia without introducing too much pressure broadening and line mixing. Nine scans were recorded with a bandpass of 1800 to 5500 cm^{-1}; seven of the scans were taken with a bandpass of 2600-8000 cm^{-1} [16]. The shortest cell was made of glass, and the others were stainless steel; the last two cells were multi-pass chambers with base lengths of 1 m and 6 m respectively. Individual line intensities were retrieved from each spectrum through non-linear least squares curve-fitting [17] in which the values of the line positions, intensities and widths were adjusted in a synthetic spectrum to reduce the residual differences between the observed and calculated spectra. The last columns of Table 1.b show the number of features measured from each spectrum in the intervals between the first and last frequencies, Fmin and Fmax; the largest optical densities were measured primarily to obtain intensities of $2\nu_4$. Measurements from different optical densities were then averaged together. For features with known assignments, the individual intensities were normalized to corresponding values at 296 K prior to the averaging. Table 2 lists a sample of individual measurements for strong, medium and weak transitions; it gives the observed position, the path and the pressure, the observed intensity at 296 K, and % difference between the individual measurement and the averaged intensity. The precisions of the intensities selected for analysis tend to fall between 2% to 8 %. The absolute accuracy is more difficult to judge; it is set conservatively to 6% even for the isolated transitions with precisions of 3% or better. Line positions from the long path data were calibrated using the 2-0 band of CO [15].

III. THEORETICAL MODEL

Our present vibration-rotational approach to the $2\nu_4/\nu_1/\nu_3$ system is formally quite similar to the approach we used for the $3\nu_2/\nu_2 + \nu_4$ system of ammonia in the 4 μm region [12]. All the couplings between $2\nu_4/\nu_1/\nu_3$ and all other bands are assumed to be weak enough to be taken into account properly by a perturbation treatment via Contact Transformation method. In fact, we know that a severe limitation to this assumption arises from the overtone band $4\nu_2^s$ and the combination band $2\nu_2 + \nu_4$ (s and a components) which are estimated to be in close coincidence with the triad $2\nu_4/\nu_1/\nu_3$ system [5], as represented in Figure 1. Nevertheless, the lack of data about these two bands does not allow us to include them in the present stage of the analysis.

As in the case of the $3\nu_2/\nu_2 + \nu_4$ system of NH_3, we used a parametrization of the vibration-inversion-rotation energy levels developed by Spirko et al. [18], and later by Urban [19] and for the intensity parametrization, we used the approach introduced by Pracna et al. [20].

Table 3 gives the exact expression of the energy matrix elements related to the interacting vibrational states $v_1=1$, $v_3=1$ and $v_4=2$. In this table, the expansion of the terms shown is limited to the fourth order for contribution diagonal in the vibrational quantum number v and to the third order of magnitude for the vibrational coupling terms. So five kinds of matrix elements are involved : a) diagonal matrix elements; b) matrix elements diagonal in the vibrational quantum numbers v_1 , v_3 and v_4 and related to "essential resonances" like "l-type interaction" within $2\nu_4$ and ν_3 and "K-type resonances" within all the vibrational states; c) Fermi-type matrix elements between $v_1=1$ and $v_4=2$ levels; d) Fermi-type matrix elements between $v_3=1$ and $v_4=2$ levels and e) Coriolis-type matrix elements coupling $v_1=1$ and $v_3=1$ states.Table 4 illustrates the upper state energy interactions presently used in the analysis of $2\nu_4$, ν_1 and ν_3.

Table 5 contains the transition dipole matrix elements corresponding to the transitions investigated in the $2\nu_4$, ν_1 and ν_3 bands. In this table, the transition matrix elements $<||\mu_Z^t||>$ are given according to the expansion of the transformed dipole moment operator μ_Z^t limited to the terms quadratic in the angular momentum components [21].

The elements given in Tables 3 and 5 are consistent with the phase conventions used in Ref. [21]. The basis wavefunctions used in those two tables are the eigenfunctions of the zero order Hamiltonian, labelled $| i, v_1, v_3, v_4, l_3, l_4; JK >$ according to Ref. [18] where i = s or a represents the inversion symmetric and antisymmetric components, respectively.

In the computer programs used in the analysis, the energy and transition matrices of Tables 3 and 5 are expressed in terms of symmetrized basis functions so that both matrices can be factorized according to the symmetry classifications of the vibration-inversion-rotation levels within the D_{3h} [18].

Note that all energy or transitions matrix elements with odd values of ΔK connect "s" and "a" states whereas elements with even ΔK values connect "s" and "s" or "a" and "a" states. After diagonalization of the energy matrix, the upper state levels will be labelled according to v_1, v_2, v_3, v_4, K, $|l_3|$, $|l_4|$ and the inversion parity "s" or "a" quantum numbers as long as the mixing due the non diagonal matrix contributions is less than 50%. If not, a labelling of the levels with stars will be used (see tables).

IV. RESULTS

In the sections that follow, we describe the a) line assignments and upper state energy parameters fits, b) analysis and fit of the line intensities and c) line-by-line prediction of these three bands.

In all our fits of the three upper state energy levels of $^{14}NH_3$ near 3 μm, the ground state parameters are fixed to the values reported by Urban et al. [22]. No attempt was done to fit the ground state parameters.

a) Line Assignments and Upper State Energy Fit

The present assignments cover the range from 2980 to 3635 cm^{-1}. Starting from the results by Guelachvili et al. [8], we completed the line assignments of ν_1, ν_3 and $2\nu_4$, as much as possible up to the rotational quantum number J' = 10. The identification of the lines, based on the ground state combination differences method allowed us to increase the number of identified lines from about 1400 to 2110. This corresponds to the identification of about 95% of the possible levels in the triad at J' = 10. In particular for the relatively weak $2\nu_4$ band, about 760 line assignments were added to the 240 initially reported. Many of the new assignments in this band correspond to lines with J' > 6 which are of great importance to model properly the resonances of the overtone with the fundamentals. For the fit of the upper state energies, all the lines which correspond to multiple or uncertain assignments were discarded, and finally 1832 lines (J' ≤ 10) were included in the fit.

The root-mean square (rms) deviations associated with the fitted positions (and intensities) are shown in Table 6; the values are given by band and also by inversion (a,s) components of the upper states. As seen there, the quality of our fit is very different for the three bands. The overall rms is 0.085 cm^{-1} with a range of 0.044 cm^{-1} for ν_3^s to 0.177 cm^{-1} for $2\nu_4^a$ (l = 0). A. In the case of ν_1, the r.m.s is similar for the transitions to "a" and "s" upper levels. For ν_3 and $2\nu_4$, the r.m.s. deviations are worse for the transitions associated with the "a" upper states than for the transitions associated with the "s" upper states. These deviations would no doubt improve if we could properly include the resonances between $2\nu_4^a$ and the yet-unassigned $(2\nu_2+\nu_4)^S$ and between ν_3^a and $4\nu_2^S$. Although these rms values are still far from the experimental uncertainties, they do represent a marked improvement over prior analyses of this region.

Table 7 lists the fitted parameters for the three $^{14}NH_3$ upper state levels, as defined by the notation of Table 3. There are 7 parameters for $v_1 = 1$, 11 for $v_3 = 1$ and

18 for $v_4=2$. The columns "s" in Table 7 give the values of the parameters for the symmetric component and the columns "a-s" give the differences of the parameters between the asymmetric and symmetric components ($\nu_1^a - \nu_1^s$, $B_1^a - B_1^s$, ... for example). Concerning the upper state $v_4=2$ no variation of the B_V, C_V D_{VJ}, D_{VJK} and D_{VK} parameters with l_4 were found to be significant. Morever, in the three upper states $v_1=1$, $v_3=1$ and $v_4=2$, the sixth order parameters H_J, H_{JK}, H_{KJ} and H_K were found to be not significantly different from their ground state value for either the asymmetric or the symmetric components. These parameters were therefore constrained to their ground state values as shown in Table 7.

No important correlations between the parameters were observed except within the Fermi-type interaction parameter $\mathcal{W}_{00}^{14,s}$ and the two band centers of $2\nu_4$ and ν_1. Nevertheless, the contribution of this Fermi-type coupling appears to be essential for a consistent fit of the data.

The Fermi interaction parameter between $2\nu_4$ and ν_1 is large (see Table 3.c.) and leads to a number vibrational mixing in the upper state levels. The value of the first order term ($\mathcal{W}_{00}^{14,s}=36.49(24)$ cm^{-1} which connects $v_4=2$, $l_4=0$ with $v_1=1$ upper state levels) is in agreement within a few percent with the values calculated previously by various methods [23-25] and its value agrees within experimental accuracy to the value evaluated to be 38 ± 8 cm^{-1} by Benedict et al. [4]. The difference $\mathcal{W}_{00}^{14,a}-\mathcal{W}_{00}^{14,s}$ as well as the rotational corrections in J and K ($w_{00J}^{1,4s}, w_{00K}^{1,4s}$) could also be determined. The second order Fermi interaction term in $\Delta K=\pm1$, $\Delta l_4=\mp2$ ($\mathcal{W}_{12}^{14}$ which connects $v_4=2$, $l_4=|2|$ with $v_1=1$ upper state levels) could not be determined and was set to zero. Note that although the $\mathcal{W}_{00}^{14,s}$ term only couples directly $v_4=2$, $l_4=0$ with $v_1=1$ upper state levels, it also induces a coupling between $v_4=2$, $l_4=|2|$ with $v_1=1$ upper state levels via l-type resonances.

No Fermi-type interaction parameters between $2\nu_4$ and ν_3 (see Table 3. d.) could be determined either because of the large difference of energy between the band centers and/or because of a smaller interaction term. Those parameters were set to zero.

The Coriolis coupling between the ν_1 and ν_3 (see Table 3.e.) bands is not very strong. Only one parameter ($\mathcal{C}_{21}^{13,s}=\mathcal{C}_{21}^{13,a}$) describing the second-order Coriolis interaction in $\Delta K=\pm2$, $\Delta l_3=\mp1$ between the two bands could be determined. An avoided crossing between the $v_1=1$, $K'=7$ and the $v_3=1$, $K'=9$, $l_3'=-1$ upper states allows us to determine the parameter responsible for this interaction. On the contrary, the first order term in $\Delta K=\pm1$, $\Delta l_3=\pm1$ ($\mathcal{C}_{11}^{13}$) was not statistically significant, did not improve the standard deviation of the fit and was therefore fixed to zero. As illustrated in Figure 2, both the parameter $\mathcal{C}_{21}^{13,s}$, and to a much smaller extent the parameter q_{3v}, are responsible for the same type of perturbation-allowed transitions $\Delta K = \pm 2$, $\Delta l_3 = \mp 1$ (a<-->s) observed in ν_3 and for the transitions $\Delta K = \pm 3$ (a<-->a and (s<-->s) observed in ν_1. Note that neither q_1 nor q_2, related to the 2-1 and 2-2 l-type resonances respectively could be determined in ν_3, and those parameters were set to zero.

On the contrary, in the $2\nu_4$ band, avoided crossings take place even at small values of K between energy levels allowing us to determine the two l-type parameters q_1 and q_2 (and even two rotational dependence q_{2J} and q_{2K}) responsible for interactions between energy levels characterized respectively by $\Delta K = \pm 1$, $\Delta l_4 = \mp 2$ (a<-->s) and $\Delta K = \pm 2$, $\Delta l_4 = \pm 2$ (s<-->s or a<-->a). As illustrated in Fig.3, the couplings generated by q_1 cannot induce perturbation-allowed transitions, whereas the couplings generated by q_2 makes pertubation-allowed transitions of the type $\Delta K = \pm 2$, $\Delta l_4 = \pm 2$ a<-->s or of the type $\Delta K = \pm 3$, $\Delta l_4 = 0$ s<--s or a<--a observable in $2\nu_4^2$ and $2\nu_4^0$ respectively. As mentioned in Section III, we kept the "s" and "a" notation for the upper state energy levels as long as the rather strong mixing between these two components remains less than 50%.

b) Intensity Fit

Some 975 intensity measurements of the three bands were selected by discarding blended features and lines which had either multiple or uncertain assignments. Transitions were also excluded if the observed-calculated positions were bigger than 0.250 cm^{-1} (i.e. about three times the standard deviation for the energy fit shown in the previous section). Table 6.b is summarizing for each of the bands the number of lines included in the intensity fit and the corresponding average values, in %, of the $| I_{obs} - I_{calc}| / I_{obs}$. The fit for the two fundamentals is the best (5-12 %) whereas for the overtone $2\nu_4$ the intensity fit is about 14 %. The fit of these 975 intensity measurements reproduces the experimental line intensities with an overall r.m.s equal to 9.4%, clearly worse than the estimated absolute uncertainty of the intensity measurements (of about 6 %). The best fit was obtained by using eleven parameters which are reported in Table 8, according to the notation of Table 5. The coefficients d_1, d_3, d_{40} and d_{42} are the leading intensity parameters related to ν_1, ν_3, $2\nu_4^0$ and $2\nu_4^{\pm 2}$ transitions respectively. All other parameters are Herman-Wallis corrections in J and K as defined in Table 5. In this fit, only the parameters showing a test value greater than twice the overall test value were retained as significant parameters. Note that the overall r.m.s deviation increases to 20.4% if the d_{31} and d_{32} Herman-wallis corrections are set to zero, and to 13.6% if the d_{11} is set to zero.

The intensity parameters are noted "d_s" or "d_a" depending whether they concern transitions originating from "s" or "a" ground state energy levels ; so for $2\nu_4^0$ or for ν_1,

"d_s" (or "d_a") concerns both allowed a<-s (or s<--a) transitions and perturbation-allowed s<--s (or a<--a) transitions. For $2\nu_4^{\pm 2}$ or for ν_3 , "d_s" (or "d_a") concerns both allowed s<--s (or a<--a) transitions and perturbation allowed a<--s (or s<--a) transitions.

Separate adjustment of the a and s dipole moment terms (by d_a-d_s terms) did not improve the standard deviations for any of the bands and so the parameters for the two components were assumed to be the same ($d_a = d_s$). The relative signs of the leading dipoles were determined by systematic test fits; the values presented in Table 8 are considered the "best choice". From these, the vibrational transitions moments and band strengths for the ν_1, ν_3 and $2\nu_4$ were derived.

The transition moments for each component have the following values :

$$<\mu_v>^s_{\nu_1} = <\mu_v>^a_{\nu_1} = |d_1{}^s| / \sqrt{2} = |d_1{}^a| / \sqrt{2} = 0.0262(1) \text{ Debye} \qquad (1)$$

$$<\mu_v>^s_{\nu_3} = <\mu_v>^a_{\nu_3} = |d_3{}^s| = |d_3{}^s| = 0.0182(1) \text{ Debye} \qquad (2)$$

$$<\mu_v>^s_{2\nu_4} = <\mu_v>^a_{2\nu_4} = \sqrt{\frac{\left|d_{40}{}^s\right|^2}{2} + \left|d_{42}{}^s\right|^2} = \sqrt{\frac{\left|d_{40}{}^a\right|^2}{2} + \left|d_{42}{}^a\right|^2} = 0.00920(6) \text{ Debye} \qquad (3)$$

These values for the ν_1 and ν_3 transition moments can be compared with the values of 0.025588(60) Debye and of 0.0193(14) Debye respectively [9]. The transition moment for $2\nu_4$ is determined here for the first time. Because of the strong l-type mixing between the parallel and the perpendicular components, it did not seem reasonable to separate the contributions of the these two components.

To understand the intensity results, it is necessary to distinguish between the vibrational band strength and the total integrated band intensity. In our case where $<\mu_v^s>$ and $<\mu_v^a>$ are the same, the vibrational band strengths can be computed from:

$$S_v = \frac{8\pi^3 \nu £ T_0}{3hcQ_v(T)T} <\mu_v>^2 \qquad (4)$$

where $<\mu_v> = <\mu_v^a> = <\mu_v^s>$, £ = 2.686 75 x 10^{19} molecules cm^{-3} atm^{-1} at T_0= 273.15 K, T=296 K, Q_v =1. and with the band centers ν from Table 7. The total integrated band intensity is the summation of all the transitions associated with a band and :

$$\sum_i S_i \approx S_v \qquad (5)$$

and the summation of all bands corresponds to the integrated absorption of a region.

The present results for integrated summations $\Sigma_i S_i$ and computed vibrational band strengths S_v are presented in the second and third column of Table 9 respectively, along with values from the literature [9, 26-28]. The present total band strengths for the region (from summing the fundamentals and the overtone) fall within 4% of the averaged intensity determined by low resolution studies of Kim et al. [26], Koops et al. [27] and McKean and Schatz [28]. While the present intensity sum for the 3 μm region is only 10% smaller than the HITRAN 96 values, clearly the database overestimates the intensities of the ν_3 parameters.

The only reported vibrational band strengths come from the work of Pine and Dang-Nhu [9]. For ν_3 our value of the band strengths agrees with the value of these authors, given the rather large uncertainty quoted in [9]. For ν_1 our band strength value is higher than Pine and Dang-Nhu's value by about 4.5%. However, as seen from the differences between our vibrational band strength and our integrated summation, such evaluations should not rely solely on the "vibrational band strength". For example, our vibrational band strengths (see column 3 of Table 9) differ from the integrated band intensities (see column 2 of Table 9) by 12% for ν_1 and 80% for $2\nu_4$, but our respective sums of the ν_1, $2\nu_4$ (and vibrationaly mixed) integrated band intensity agree with the sums of the vibrational band strengths (26.2 versus 26.4). This in fact indicates that we should maybe reconsider the way we label the upper state energy levels (done by examining if the vibrational mixing is less than 50%, as explained at the end of Section III). Indeed, the very strong mixing of $\nu_1$and $2\nu_4$ distroys the vibrational quantum numbers v_1 and v_4, making the vibrational assignment meaningless for many transitions. In this context, it is useless to compare the results of Pine and Dang-Nhu with ours for ν_1, as those authors have no band strength value for $2\nu_4$ and they have used a different theoretical model. Rather, the intercomparison is best done through line-by-line evaluation of observed linestrengths, and the examination of some 40 intensities measured by both studies reveals that the present measurements are only systematically 3% lower than Pine and Dang-Nhu's for both fundamentals.

The vibrational band strengths and integrated summations in Table 9 also provide some understanding about the effect of the resonance between the overtone and the fundamental. The vibrational bandstrengths values are closer to the intensities that the bands would have if the Fermi resonance were weak. The difference between the overtone's vibrational and integrated strengths shows how much intensity is being transferred from the fundamental into the overtone.

Appendix 1 shows a comparison between measured and calculated intensities using the energy and intensity parameters from Table 7 and 8. For each line, they include the line assignments (lower level and upper level), the observed wavenumbers, the difference between observed and calculated frequencies (in 10^{-3} cm^{-1}), the measured intensities (S_0), the estimated measurement uncertainty in %, the difference between measured and calculated intensity in % (S_0-S_c/S_0), and the number of scans used for the intensity measurement. In the Appendix, we have only reported the transitions which were included in the intensity fit, all with a weight equal to 1. The complete list of measured intensities (including some good measurements that we discarded because of the criteria mentioned in the beginning of this section) can be obtained from two of the authors of the author (I.K and L. B.) and is in deposit by the Journal.

c) Line-by-line prediction of ν_1, ν_3 and $2\nu_4$.

Results of Table 7 and 8 were also used to generate a line-by-line frequency and intensity prediction of $^{14}NH_3$ due to the $\nu_1/\nu_3/2\nu_4$ system for all the transitions with J' $\leq$ 10 with a predicted intensity cut-off of 1.10^{-4} cm^{-2} atm^{-1} at 296K (2749 transitions from 2980.4 to 3633.8 cm^{-1}) which seems reasonable for planetalogy purposes.

This complete data file will be submitted to the HITRAN and GEISA database [29,30] (and also to the planetary community); it is available in electronic form from two of the authors (Kleiner, Brown) and from the Journal. This file includes all the informations needed to generate spectra at different temperatures in emission or in absorption, i.e. line assignments, observed frequencies, observed-calculated values (in 10^{-4} cm^{-1}), line intensities and upper and lower energy levels. Note that the observed energy levels are used whenever they are known. Finally Fig. 4 shows the quality of our prediction in a portion of the NH_3 absorption spectrum around 3450 cm^{-1}.

d) Partial Assignment of $4\nu_2{}^s$

The rather large discrepancies observed in our fits for the component $2\nu_4$ $l=0$ (a<--s) can be ascribed unambiguously to a Coriolis-type interaction with the "s" component of $2\nu_2 + \nu_4$ (see energy diagram of figure 1). Unfortunately, all attempts to locate this "dark" state in the room temperature FT spectrum and in the FT spectrum at 200 K were unsuccessful up to now. For ν_3, it is interesting to note that an "isolated" band fit of only the ν_3 line positions (without involving any interaction with other bands) gives a rms of 0.064 cm^{-1} for the s<--s component and a rms of 0.062 cm^{-1} for the a<--a component. Those results, when compared to the fit within the triad model (present analysis with the Coriolis -type interaction between ν_1 and ν_3 and the Fermi-type interaction between ν_1 and $2\nu_4$), show that the triad treatment contributes to improve the s<--s component (rms of 0.044 cm^{-1}) of the ν_3 more than the a<--a component (rms of 0.066 cm^{-1}). We conclude thus that the upper state $v3=1$ "a" state is perturbed by a band which is not included in our model. The obvious candidates are $4\nu_2{}^s$ and $(2\nu_2 + \nu_4)^a$. As already suggested by Angstl et al.[5], the interaction between $\nu_3{}^a$ and $4\nu_2{}^s$ which requires terms in $\Delta K = \pm 1$, $\Delta l_3 = \pm 1$ terms, seems to us more probable than the one between $\nu_3{}^a$ and $(2\nu_2 + \nu_4)^a$ which requires terms in $\Delta K = \pm 2$, $\Delta l_3 = \pm 1, \Delta l_4 = \pm 1$. This hypothesis was confirmed by the fact that after searching for a long time in the FT spectrum at 200 K, we were actually able to assign some 40 lines that correspond to transitions to $4\nu_2$ (s), centered at 3462 cm^{-1}, using ground state combinations and an initial prediction of the line positions perfomed using the rotational parameters of $3\nu_2$ [12].Table 10 lists the tentative assignments for this state and gives measured line intensities and Fig. 5 shows some of the assigned lines of this overtone. Several attempts to fit those $4\nu_2$ lines, treating this band as an isolated band lead to an root-mean-square deviations of about 0.090 cm^{-1}, showing that this band is also strongly perturbed. From preliminary isolated band analysis, we estimated that the band strength of $4\nu_2$ (s) is in the range of about 0.1 cm^{-2}/atm at 295 K.

V. DISCUSSION

With ammonia, determinating the true precision and absolute accuracy of the measured intensities is complicated because of the behavior of the gas sample [16]. With the results completely tabulated, it is appropriate to return to this question again. In the *experimental section*, the estimated precisions were stated to be perhaps 3% because of the experimental uncertainty based on the agreement between individual spectra, as demonstrated in Table 2. The modeling has shown that the "a" and "s" components of the fundamentals generally have the same intensity. This provides a separate validation of the prior experimental precision estimate because the ratio of the intensities for 50 (randomly selected) a and s pairs of ν_1 and ν_3 lines is 1.002 with an rms value of 2.8%. Understanding the absolute accuracy is more difficult; it ultimately is obtained from the agreement with other studies. For the 3 μm region of ammonia, the only other line-by-line measurements are those of Pine and Dang-Nhu [9] which are systematically 3% higher than the present observed intensities. However, given our experience with ammonia samples, we conservatively set a value of 6% as the absolute accuracy.

VI. CONCLUSIONS

The study of the ν_1/ν_3 /$2\nu_4$ system of $^{14}NH_3$ presented in this paper extents the knowledge of the very complex NH_3 spectrum in the 3 μm region. The analysis of line positions include now the three leading vibrational bands which represent the quasi-totality of the absorption present in this spectral range. The modeling of the three bands within a triad system allow us to account properly for all the rovibrational couplings between them, mainly the strong Fermi interaction between ν_1 and $2\nu_4$. The set of upper state energy parameters includes only 41 parameters for 1832 line positions fitted (which corresponds to about 640 energy levels) with only one strong correlation between two parameters. Note that the standard deviation of the fit (0.085 cm^{-1}) remains largely beyond the experimental line positions uncertainties (of about 0.0005 cm^{-1}). The observed discrepancies reveals strong vibrational interactions with the last two bands present in the range, i.e $4\nu_2$ and $2\nu_2 + \nu_4$ which could not be included in the polyad interacting system at the present stage of the investigation. Indeed no more than 40 transitions of $4\nu_2$ (s) could be assigned up to now around 3462 cm^{-1} and no identification of $2\nu_2 + \nu_4$ could be done on basis of the ground state combination differences because of the weakness of this band.

The intensity analysis which includes for the first time $2\nu_4$, in addition to $\nu_1$and ν_3, allows us to reproduce 975 intensity measurements using 11 significant parameters with a standard deviation of 9.4% for an experimental uncertainty of about 6%. It points out quite well an intensity distribution strongly influenced by the coupling between ν_1 and $2\nu_4$ as illustrated in table 9. Finally the results of the analysis leads to a line-by-line prediction of the three bands ν_1, ν_3 and $2\nu_4$, reliable enough up to $J' = 10$ for planetary applications. Such a prediction was indeed successfully used for the interpretation of Jovian spectra recently recorded [3].

The first objective of any future study of this region should be to locate the fifth band $2\nu_2 + \nu_4$. Additional experimental data involving more cold data can facilitate this search. The maximum optical densities available to the present study have been a few spectra recorded with a path of 16.4 m and pressures of 3 to 10 Torr near 200 K. In these data, there are a number of weak features near 3200 cm^{-1} that are clearly arising from small lower state energies and are thus likely to belong to the s combination band. However, these features are perhaps a factor of five weaker than the $4\nu_2$ (s) assigned lines and could not be assigned using ground state combination differences. Thus new cold data recorded with path lengths on the order of 100 m would be very helpful for future studies of this region. However, a careful empirical determination of the lower state energies (as was done for the 2 µm region of NH_3 [16]) would promote the assignment of these dark states. It also may helpful to locate this state by doing simultaneous assignment of the $2\nu_2 + \nu_4 - \nu_2$ hot band near 4µm.

Our present analysis can be extended to identify numerous unassigned lines at 4 µm [12] and 5 µm [31] which are in fact hot band transitions having the 3 µm levels as upper states. The experimental upper state levels used in the prediction combined with the two lowest fundamentals will permit line positions to be predicted with accuracies of 0.001 cm^{-1} or better, and spectra recorded for the 3 µm study will be available for the analysis of the hot band intensities. This can lead to a full characterization of the important 5 µm region used extensively for planetary studies.

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Tables captions

Table 1. Experimental conditions of the Kitt Peak spectra and of LPMA spectra.

Table 2. Comparison of individual measurements from Kitt Peak Spectra.

Table 3. Upper state energy matrix for the $\nu_1/\nu_3/2\nu_4$ system of NH_3

Table 4. Upper state Interactions used involved in the present analysis of .the $\nu_1/\nu_3/2\nu_4$

Table 5. M-reduced dipole transition matrix[a] for the $\nu_1/\nu_3/2\nu_4$ system of NH_3

Table 6. Statistics for fitted line positions and intensities[a].

Table 7. Energy parameters[a] for the $\nu_1/\nu_3/2\nu_4$ system of $^{14}NH_3$

Table 8. Intensity parameters[a]·for the $\nu_1/\nu_3/2\nu_4$ system of $^{14}NH_3$

Table 9: Comparison of bandstrengths from present work and from literature (in cm^{-2} atm^{-1}at 296K) for the ν_1, ν_3 and $2\nu_4$ bands of $^{14}NH_3$.

Table 10. Tentative assignments for $4\nu_2$ (a-->s) of $^{14}NH_3$.

Appendix 1. Comparison of measured and calculated line intensities in ν_1, ν_3 and $2\nu_4$.

LPMA spectra

Spect. Num.	Press. Torr	Path M	Fmin cm-1	Fmax cm-1	Etalon Band
1709	2.36	20.18	3030.7	4801.0	CO 2-0
1733	0.23	28.18	2959.0	4371.0	CO 2-0
2069	0.04	32.18	2191.0	4201.2	CO 1-0
2071	0.15	32.18	2191.0	4201.2	CO 1-0
2077	0.56	32.18	2191.0	4201.2	CO 1-0

Kitt Peak Spectra

Press. Torr	Path M	Temp K	Fmin cm-1	Fmax cm-1	# lines measured
3.82	0.10	296.2	3234.5	3546.1	219.
5.27	0.10	296.2	3234.5	3564.2	272.
7.80	0.10	296.2	3140.3	3564.2	399.
10.40	0.10	296.2	3128.3	3564.2	452.
14.40	0.10	296.2	3105.9	3564.2	480.
1.07	0.25	291.5	3213.4	3546.1	173.
2.84	0.25	290.7	3210.5	3564.2	362.
5.42	0.25	295.8	3173.5	3557.6	453.
8.51	0.25	295.8	3161.2	3498.5	423.
1.01	1.50	294.0	3200.5	3570.0	680
2.60	1.50	294.6	2979.9	3570.0	1363.
1.89	4.34	295.8	3344.6	3548.0	1005.
6.90	8.40	295.0	2979.9	3504.2	2625.
1.05	25.00	295.0	2979.9	3504.0	2507.
0.53	73.00	296.0	2979.9	3369.2	1760.
6.20	25.00	297.7	2979.9	3368.2	1425.

The shortest absorption cell was glass and the others ere stainless steel. The last two cells were multi-pass ells. Fmin, Fmax indicates the spectral interval from which ntensity measurements were retrieved.

Position cm-1	diff.	Path M	Press. Torr	Intensity cm-2/atm	%diff	Temp K
3295.387480	-0.00027	0.2500	2.840	2.00 E- 1	1.7	290.7
3295.387590	-0.00016	0.2500	1.070	1.99 E- 1	1.5	291.5
3295.387706	-0.00005	0.2500	5.420	1.87 E- 1	-4.8	295.8
3295.387824	0.00007	0.1000	10.400	1.98 E- 1	1.0	296.2
3295.387843	0.00009	0.1000	5.270	1.94 E- 1	-1.2	296.2
3295.387843	0.00009	0.1000	14.400	2.01 E- 1	2.5	296.2
3295.387862	0.00011	0.1000	7.800	1.98 E- 1	0.6	296.2
3295.387863	0.00011	0.1000	3.820	1.94 E- 1	-1.4	296.2
erage = 3295.387751	0.00014 (=rms)			1.96 E- 1	2.2 (=%rms)	
3235.991488	-0.00027	0.2500	5.420	3.56 E- 2	-2.9	295.8
3235.991617	-0.00014	1.5000	2.596	3.71 E- 2	1.3	294.6
3235.991656	-0.00010	1.5000	1.010	3.56 E- 2	-2.8	294.0
3235.991660	-0.00010	0.1000	14.400	3.79 E- 2	3.5	296.2
3235.991798	0.00004	0.1000	10.400	3.82 E- 2	4.4	296.2
3235.991817	0.00006	0.1000	7.800	3.78 E- 2	3.1	296.2
3235.991829	0.00007	0.2500	2.840	3.63 E- 2	-0.9	290.7
3235.991891	0.00013	0.1000	5.270	3.62 E- 2	-1.2	296.2
3235.992064	0.00031	0.2500	8.510	3.50 E- 2	-4.3	295.8
verage = 3235.991758	0.00016 (=rms)			3.66 E- 2	3.0 (=%rms)	
3244.141095	-0.00087	73.0000	0.526	2.26 E- 3	3.2	296.0
3244.141384	-0.00058	25.0000	6.200	2.21 E- 3	0.8	297.7
3244.142001	0.00004	1.5000	2.596	2.11 E- 3	-3.5	294.6
3244.142220	0.00026	25.0000	1.050	2.17 E- 3	-1.1	295.0
3244.143119	0.00116	8.4000	6.900	2.20 E- 3	0.6	295.0
verage = 3244.141964	0.00071 (=rms)			2.19 E- 3	2.2 (=%rms)	
3248.852587	-0.00093	73.0000	0.526	2.35 E- 4	0.1	296.0
3248.852895	-0.00062	25.0000	6.200	2.42 E- 4	3.1	297.7
3248.853992	0.00048	25.0000	1.050	2.27 E- 4	-3.0	295.0
3248.854583	0.00107	8.4000	6.900	2.34 E- 4	-0.2	295.0
verage = 3248.853514	0.00081 (=rms)			2.34 E- 4	2.2 (=%rms)	

a) diagonal[b,c]

$< i, v, \ell_3, \ell_4 ; JK \mid i, v, \ell_3, \ell_4 ; JK > = \nu_v^i + B_v^i J(J+1) + (C_v^i - B_v^i) K^2 - D_v^{J,i} J^2 (J+1)^2 - D_v^{JK,i} J(J+1) K^2 - D_v^{K,i} K^4 + H_v^{J,i} J^3 (J+1)^3 + H_v^{JK,i} J^2 (J+1)^2 K^2 + H_v^{KJ,i} J(J+1) K^4 + H_v^{K,i} K^6 - 2 \sum_{t=3,4} (C\zeta)_t^i K\ell_t + \sum_{t=3,4} (\eta_t^{J,i} J(J+1) K\ell_t + \eta_t^{K,i} K^3 \ell_t) + g_4^i \ell_4^2 + \delta B_v^i J(J+1) \ell_4^2 + (\delta C_v^i - \delta B_v^i) K^2 \ell_4^2$

b) essential resonances[b,c]

$<s, v, \ell_3, \ell_4 ; JK \mid a, v, \ell_3, \ell_4 ; J, K \pm 3 > = F_3^{\pm}(J,K) [q_{3v} (2K \pm 3) \pm r_{3v} + \sum_{t=3,4} d_{3t} \ell_t]$

$<a, v, \ell_3, \ell_4 ; JK \mid s, v, \ell_3, \ell_4 ; J, K \pm 3 > = F_3^{\pm}(J,K) [q_{3v} (2K \pm 3) \mp r_{3v} + \sum_{t=3,4} d_{3t} \ell_t]$

$<i, v, \ell_3, \ell_4 ; JK \mid i, v, \ell_3, \ell_4 ; J, K \pm 6 > = F_6^{\pm}(J,K) f_6^i$

$<_a^s, 0, 1, 0, \pm 1, 0 ; JK \mid _s^a, 0, 1, 0, \mp 1, 0 ; J, K \pm 1 > = 2(2K \pm 1) F_1^{\pm}(J,K) [q_1^3 + q_{1J}^3 J(J+1) + q_{1K}^3 (2K \pm 1)^2]$

$<i, 0, 1, 0, \mp 1, 0 ; JK \mid i, 0, 1, 0, \pm 1, 0 ; J, K \pm 2 > = 2F_2^{\pm}(J,K) [q_2^{3i} + q_{2J}^{3i} J(J+1) + q_{2K}^{3i} (2K \pm 2)^2]$

$<i, 0, 1, 0, \pm 1, 0 ; J,K \mid i, 0, 1, 0, \mp 1, 0 ; J, K \pm 4 > = 2 F_4^{\pm}(J,K) f_4^{3i}$

$<_a^s, 0, 0, 2, 0, \ell_4 ; JK \mid _s^a, 0, 0, 2, 0, \ell_4 \mp 2 ; J, K \pm 1 > = \sqrt{8} F_1^{\pm}(J,K) \{(2K \pm 1)[q_1^4 + q_{1J}^4 J(J+1) + q_{1K}^4 (2K \pm 1)^2] + d_1^4 (\ell_4 \mp 1)\}$

$<_a^s, 0, 0, 2, 0, \mp 2 ; JK \mid _s^a, 0, 0, 2, 0, \pm 2 ; J, K \pm 1 > = \sqrt{8} F_1^{\pm}(J,K) f_{14}^4$

$<i, 0, 0, 2, 0, \ell_4 ; JK \mid i, 0, 0, 2, 0, \ell_4 \pm 2 ; J, K \pm 2 > = \sqrt{8} F_2^{\pm}(J,K) [q_2^{4i} + q_{2J}^{4i} J(J+1) + q_{2K}^{4i} (2K \pm 2)^2$

$<i, 0, 0, 2, 0, \pm 2 ; JK \mid i, 0, 0, 2, 0, \mp 2 ; J, K \pm 2 > = 8 F_2^{\pm}(J,K) f_{24}^{4i}$

$<i, 0, 0, 2, 0, \ell_4 ; JK \mid i, 0, 0, 2, 0, \ell_4 \mp 2 ; J, K \pm 4 > = 8 F_4^{\pm}(J,K) f_{42}^{4i}$

c) Fermi-type coupling $2\nu_4/\nu_1$[c]

$<i, 0, 0, 2, 0, 0 ; JK \mid i, 1, 0, 0, 0, 0 ; J, K > = W_{00}^{14,i} + W_{00J}^{14,i} J(J+1) + W_{00K}^{14,i} K^2$

$<i, 0, 0, 2, 0, \ell_4 ; JK \mid i', 1, 0, 0, 0, \ell_4 \mp 2 ; J, K \pm 1 > = \pm F_1^{\pm}(J,K) [W_{12}^{14,i} \mp W_{12K}^{14,i} (2K \pm 1)]$

$<i, 0, 0, 2, 0, \ell_4 ; JK \mid i, 1, 0, 0, 0, \ell_4 \pm 2 ; J, K \pm 2 > = F_2^{\pm}(J,K) W_{22}^{14,i}$

[a] The elements are given according to the phase conventions of Ref (21). They are expanded to the fourth order, except Coriolis and Fermi terms which are limited to the third order.

[b] v represents the set (v_1, v_3, v_4) equal to (1,0,0), (0,1,0) and (0,0,2) for the upper states of ν_1, ν_3 and $2\nu_4$, respectively.
If v ≡ (1,0,0), then $\ell_3 = \ell_4 = 0$; if v ≡ (0,1,0), then $\ell_3 = \pm 1, \ell_4 = 0$; if v ≡ (0,0,2), then $\ell_3 = 0, \ell_4 = 0, \pm 2$.

[c] In all elements < i, ... | i, ... >=..., the index i represents s or a
In all elements < i, ... | i', ... >=..., the pair (i, i') represents (s, a) or (a, s)

d) Fermi-type coupling $2\nu_4/\nu_3{}^c$

$$\langle i, 0, 0, 2, 0, \mp 2 ; JK | i, 0, 1, 0, \pm 1, 0 ; J, K \rangle = \mp [W_{012}^{34,i} \mp W_{012K}^{34,i} K + W_{012J}^{34,i} J(J+1) + W_{012K2}^{34,i} K^2]$$

$$\langle i, 0, 0, 2, 0, 0 ; JK | i', 0, 1, 0, \pm 1, 0 ; J, K\pm 1 \rangle = F_1^{\pm}(J, K) [W_{110}^{34,i} \mp W_{110K}^{34,i} (2K\pm 1)]$$

$$\langle i, 0, 0, 2, 0, \mp 2 ; JK | i', 0, 1, 0, \mp 1, 0 ; J, K\pm 1 \rangle = F_1^{\pm}(J, K) [W_{112}^{34,i} \mp W_{112K}^{34,i} (2K\pm 1)]$$

$$\langle i, 0, 0, 2, 0, 0 ; JK | i, 0, 1, 0, \mp 1, 0 ; J, K\pm 2 \rangle = \mp F_2^{\pm}(J, K) W_{210}^{34,i}$$

$$\langle i, 0, 0, 2, 0, \pm 2 ; JK | i, 0, 1, 0, \pm 1, 0 ; J, K\pm 2 \rangle = \mp F_2^{\pm}(J, K) W_{212}^{34,i}$$

e) Coriolis-type coupling $\nu_1/\nu_3{}^c$

$$\langle i, 1, 0, 0, 0, 0 ; JK | i', 0, 1, 0, 0, \pm 1 ; J, K\pm 1 \rangle = 2 F_1^{\pm}(J,K) [C_{11}^{13,i} \mp C_{11K}^{13,i} (2K \pm 1) + C_{11J}^{13,i} J(J+1) + C_{11K2}^{13,i} (2K \pm 1)^2]$$

$$\langle i, 1, 0, 0, 0, 0 ; JK | i, 0, 1, 0, 0, \mp 1 ; J, K\pm 2 \rangle = \pm 2F_2^{\pm}(J, K) [C_{21}^{13,i} \pm C_{21K}^{13,i} (2K\pm 2) + C_{21J}^{13,i} J(J+1) + C_{21K2}^{13,i} (2K \pm 2)^2]$$

$$\langle i, 1, 0, 0, 0, 0; JK | i, 0, 1, 0, 0, \pm 1 ; J, K\pm 4 \rangle = \pm \sqrt{2} F_4^{\pm}(J, K) \; C_{41}^{13,i}$$

$F_1^{\pm}(J, K) = [J(J+1) - K(K\pm 1)]^{1/2}$; $F_2^{\pm}(J, K) = F_1^{\pm}(J, K) F_1^{\pm}(J, K\pm 1)$; ...

	INTERACTION TYPE		ENERGY PARAMETERS according to Table III.
-FERMI-TYPE COUPLING	between $v_1=1$ and $v_4=2$	$\Delta v_1=\pm1$, $\Delta v_4=\mp2$; $\Delta l_4=0$, $\Delta K=0$	$W_{00}^{14,s}$, $W_{00}^{14,a}$, $W_{00J}^{14,s}$, $W_{00K}^{14,s}$,
-CORIOLIS-TYPE COUPLING			
	between $v_1=1$ and $v_3=1$	$\Delta v_1=\pm1$, $\Delta v_3=\mp1$; $\Delta K=\pm2$, $\Delta l_3=\mp1$	$C_{21}^{13,s,a}$
-"ESSENTIAL RESONANCES"			
- l-TYPE INTERACTION	in $v_4=2$	$\Delta K=\pm1$, $\Delta l_4=\mp2$	q_1^{4}
		$\Delta K=\pm2$, $\Delta l_4=\pm2$	$q_2^{4,s}$, $q_{2J}^{4,s}$, $q_2^{4,a}$, $q_{2K}^{4,a}$
- $\Delta K=\pm3$ INTERACTION			
	in $v_4=2$	$\Delta K=\pm3$	q_{3v} fixed to ground state value[a]
	in $v_3=1$	$\Delta K=\pm3$	q_{3v} fixed to ground state value[a]
	in $v_1=1$	$\Delta K=\pm3$	q_{3v} fixed to ground state[a]

[a] According to Ref. [22].

a) ν_1[b]

$$< i, v = 0 ; JK||\mu_Z|| i', v_1=1 ; JK > = \frac{1}{\sqrt{2}} [d^i_1 + d^i_{12} J (J+1) + d^i_{14} K^2] KF_{00}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_1=1 ; J'K > = \frac{1}{\sqrt{2}} [d^i_1 + d^i_{11} m + d^i_{13} m^2 + d^i_{14} K^2] F_{10} (m K)$$

$$< i, v = 0 ; JK||\mu_Z|| i, v_1=1 ; J,K\pm 3 > = \frac{1}{\sqrt{2}} d^i_{13} F^{\pm}_{03} (J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i, v_1=1 ; J',K\pm 3 > = \frac{1}{\sqrt{2}} d^i_{13} F^{\pm}_{13} (m K)$$

b) ν_3[b]

$$< i, v = 0 ;JK||\mu_Z|| i, v_3=1, \ell_3 =\pm 1;J, K\pm 1 > = \pm\frac{1}{2} [d^i_3 \pm d^i_{32} (2K\pm 1)+ d^i_{33}J(J+1)+ d^i_{35}(2K\pm 1)^2]F^{\pm}_{01}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i, v_3= 1, \ell_3=\pm 1 ; J', K\pm 1 > = \pm\frac{1}{2} [d^i_3 + d^i_{31} m \pm d^i_{32}(2K\pm 1) + d^i_{34} m^2 + d^i_{35}(2K\pm 1)^2 \pm d^i_{36}m (2K\pm 1)] F^{\pm}_{11} (m K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_3=1, \ell_3 = \pm 1 ; J, K\mp 2 > = \frac{1}{2} [d^i_{37} \pm d^i_{39} (2K\mp 2)] F^{\mp}_{02}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_3=1, \ell_3= \pm 1 ; J', K\mp 2 > = \frac{1}{2} [d^i_{37} + d^i_{38} m \pm d^i_{39} (2K\mp 2)] F^{\mp}_{12}(m K)$$

c) $2\nu_4$[b]

$$< i, v = 0 ; JK||\mu_Z|| i', v_4=2, \ell_4=0 ; J, K > = -\frac{1}{\sqrt{2}} [d^i_{40} \pm d^i_{402} J(J+1)+ d^i_{404} K^2] KF_{00}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_4= 2, \ell_4=0; J', K > = -\frac{1}{\sqrt{2}} [d^i_{40} + d^i_{401} m + d^i_{403} m^2 + d^i_{404} K^2] F_{10} (m K)$$

$$< i, v = 0 ; JK||\mu_Z|| i, v_4=2, \ell_4=\mp 2 ; J, K\pm 1 > = \frac{1}{2} [d^i_{42} \pm d^i_{422} (2K\pm 1)+ d^i_{423} J(J+1)+ d^i_{425} (2K\pm 1)^2] F^{\pm}_{01}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i, v_4=2, \ell_4=\mp 2 ; J', K\pm 1 > = \frac{1}{2} [d^i_{42} + d^i_{421} m \pm d^i_{422} (2K\pm 1)+ d^i_{424} m^2 + d^i_{425} (2K\pm 1)^2 \pm d^i_{426} m (2K\pm 1)] KF^{\pm}_{11}(m K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_4=2, \ell_4=\pm 2 ; J, K\pm 2 > = \mp \frac{1}{2} [d^i_{427} \mp d^i_{429} (2K\pm 2)] F^{\pm}_{02}(J K)$$

$$< i, v = 0 ; JK||\mu_Z|| i', v_4=2, \ell_4=\pm 2 ; J', K\pm 2 > = \mp \frac{1}{2} [d^i_{427} + d^i_{428} m \mp d^i_{429} (2K\pm 2)] F^{\pm}_{12}(m K)$$

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[a] $< ||\mu_Z|| >$ is defined according to Ref (21), Eq.2 ; $v = 0$ represents $(v_1, v_3, v_4) \equiv (0,0,0)$ for the ground state.
The first subscripts 1,3 and 4, in the intensity coefficients are related to ν_1, ν_3 and ν_4, respectively ;
$m = J + 1$ and $- J$ for $J' = J+1$ (R branch) and $J - 1$ (P branch), respectively ;
F functions are expressed in terms of J, m and K in Table XIV of Ref (21).

[b] In all elements $< i, ...||\mu_Z||i, ... >=...$, the index i represents s or a
In all elements $< i, ...||\mu_Z||i', ... >=...$, the pair (i, i') represents (s, a) or (a, s)

	A) Fit of the line positions[a]		B) Fit of the line intensities[a]	
	Number of Lines	rms (cm^{-1})	Number of Lines	rms (%)
ν_1	309	0.074	165	5.0
a<--s,a	166	0.073	87	5.2
s<--a,s	143	0.074	78	4.8
ν_3	722	0.056	325	11.9
a<--a,s	355	0.066	157	11.4
s<--s,a	367	0.044	168	12.3
$2\nu_4(l = 0)$	185	0.115	123	13.9
a<--s,a	41	0.177	22	13.8
s<--a,s	144	0.090	101	14.0
$2\nu_4(\|l\| = 2)$	579	0.106	328	14.6
a<--a,s	278	0.109	151	13.9
s<--s,a	301	0.102	177	15.2
vibrationally mixed	37	0.090	34	14.9
Global Fit	1832	0.085	975	9.4
Number of Parameters	41		11	

[a]The results include for each band, all the transitions going up successively to "s" or "a" upper state components. The two inversion parities of the lower state indicate symmetry allowed (listed first) and "perturbation-allowed" (listed second) transitions respectively. For example, in ν_3, the allowed transitions are a<--a and s<--s.

		ν_1		ν_3		$2\nu_4$	
		s	a-s	s	a-s	s	a-s
a) diagonal	ν	3323.71(18)	2.90(8)	3443.677(30)	0.31(3)	3228.42(18)	1.45(3)
	x_{ll}					0.733(8)	
	B_v	9.813(3)	-0.005053222[b]	9.764(2)	-0.0025(6)	10.413(1)	0.0575(9)
	C_v	6.192(3)	0.002000294[b]	6.230(2)	0.002000294[b]	6.099(2)	0.002000294[b]
	$D_{vJ} \times 10^3$	0.63(3)	-0.016781[b]	0.74(1)	-0.016781[b]	1.28(2)	-0.016781[b]
	$D_{vJK} \times 10^2$	-0.103(8)	0.00463532[b]	-0.150(3)	0.00463532[b]	-0.254(6)	0.00463532[b]
	$D_{vK} \times 10^3$	0.57(6)	-0.0317569[b]	0.95(2)	-0.0317569[b]	1.45(3)	-0.0317569[b]
	$H_{vJ} \times 10^6$	0.25914[b]	-0.038549[b]	0.25914[b]	-0.038549[b]	0.25914[b]	-0.038549[b]
	$H_{vJK} \times 10^6$	-0.9056[b]	0.158387[b]	-0.9056[b]	0.158387[b]	-0.9056[b]	0.158387[b]
	$H_{vKJ} \times 10^5$	0.10796[b]	-0.0214917[b]	0.10796[b]	-0.0214917[b]	0.10796[b]	-0.0214917[b]
	$H_{vK} \times 10^6$	-0.4151[b]	0.096701[b]	-0.4151[b]	0.096701[b]	-0.4151[b]	0.096701[b]
	$(C\zeta)_v$			0.286(3)	0.	-1.373(2)	-0.033(3)
	$\eta_v^J \times 10^2$			-0.12(1)	0.	0.	0.28(2)
	$\eta_v^K \times 10^2$			0.14(1)	0.	0.	-0.37(2)
b) essential	$q_{3v} \times 10^3$	0.105[b]	0.	0.105[b]	0.	0.105[b]	0.
	q_1			0.	0.	0.0137(6)	0.
	q_2			0.	0.	0.0827(6)	0.0156(3)
	$q_{2J} \times 10^4$			0.	0.	-0.93(6)	
	$q_{2K} \times 10^4$						-0.21(6)
c) Fermi $2\nu_4/\nu_1$	$W_{00}^{14,s}$	36.49(24)					
	$W_{00}^{14,a} - W_{00}^{14,s}$	-2.93(9)					
	$W_{00J}^{14,s}$	-0.041(3)					
	$W_{00K}^{14,s}$	0.037(3)					
d) Coriolis ν_1/ν_3	$C_{21}^{13,s} = C_{21}^{13,a}$	0.0237(9)					

[a]The quoted errors represent three standard deviation. For each band, the column "s" and "a-s" give the values of ν^s, B_v^s, ...and $\nu^s - \nu^a$, $B_v^s - B_v^a$, ... respectively.
[b]Fixed to Ground State Values determined in Ref.[22].

Leading Terms[b]

	$d_s = d_a$
d_1 (ν_1)	0.0370(2)
d_3 (ν_3)	−0.0182(1)
d_{40} ($2\nu_4^0$)	−0.0017(1)
d_{42} ($2\nu_4^{\pm 2}$)	−0.00912(5)

Herman-Wallis Terms[b]

	$d_s = d_a$
d_{11} (ν_1)	$0.90(3) \times 10^{-3}$
d_{31} (ν_3)	$0.145(2) \times 10^{-2}$
d_{32} (ν_3)	$-0.47(1) \times 10^{-3}$
d_{401} ($2\nu_4$)	$0.16(2) \times 10^{-3}$
d_{422} ($2\nu_4$)	$-0.116(9) \times 10^{-3}$
d_{427} ($2\nu_4$)	$0.126(8) \times 10^{-3}$
d_{421} ($2\nu_4$)	$0.34(1) \times 10^{-3}$

[a] The quoted errors represent one standard deviation. $d_0^s, d_{01}^s, d_1^s, \ldots$ are related to transitions from ground state s levels, $d_0^a, d_{01}^a, d_1^a, \ldots$ are related to transitions from ground state a levels. The signs of intensity parameters are correlated to those of the energy parameters given in Table 3.
[b] The differences d^a-d^s were not found to be significant and were set to zero.

Band Centers (cm-1)	Integrated Vibrational Band Strength $\Sigma_i S_i$		Bandstrengths (present work) S_v		Bandstrengths (from Ref. (9))	Hitran 96[1]	Other[2]
($2\nu_4$) 3228.42(18)	5.06	26.21	2.82(4)	26.37	22.54(11)	20.5	
(ν_1) 3323.71(18)	20.61		23.55(26)				
Vibrationaly mixed	0.54						
(ν_3) 3443.677(30)	10.93		11.77(13)		13.3(2.1)	21.4	
Total	37.14		38.14 (40)				39.6(5.3)

[1]Hitran 96 [29] value is from Urban and Pracna, unpublished results (1993).
[2]Other is the average of three laboratory measurements of integrated absorption in the 3 μm region: 39.9 by Kim [26], 46.0 by Koops et al. [27]; 33.0 by McKean and Schatz [28].

Rotational Assignment J" K"	J' K'	Observed cm-1	Obs. Int cm-2/atm at 295 K	Exp Unc %	Lower State cm-1	Obs. Upper cm-1
(0)P (2 A+ 0 a)	1 0 a	3419.20101	1.46E-03	(3.8)	60.41301	3479.61402
(0)R (0 A+ 0 a)	1 0 a	3478.82128	9.46E-04	(4.7)	0.79340	3479.61468
(0)P (2 E 1 a)	1 1 a	3420.40404	1.29E-03	(3.0)	56.70921	3477.11325
(0)Q (1 E 1 a)	1 1 a	3460.14989	3.43E-03	(3.0)	16.96335	3477.11324
(0)P (3 E 2 a)	2 2 s	3400.00004	2.56E-03	(3.5)	105.18374	3505.18378
(0)Q (2 E 2 a)	2 2 s	3459.59695	4.73E-03	(3.0)	45.58728	3505.18423
(0)P (3 E 1 a)	2 1 a	3395.63500			116.27827	3511.91327
(0)Q (2 E 1 a)	2 1 s	3455.20300	3.36E-04	(10.9)	56.70921	3511.91221
(0)R (1 E 1 a)	2 1 s	3494.94900	8.45E-04	(7.0)	16.96335	3511.91235
(0)P (4 A+ 0 a)	3 0 s	3367.28600	8.79E-04	(10.2)	199.29390	3566.57990
(0)R (2 A+ 0 a)	3 0 a	3506.16700	3.22E-03	(3.0)	60.41301	3566.58001
(0)P (4 A- 3 a)	3 3 s	3379.62174	8.74E-04	(14.0)	166.08789	3545.70963
(0)Q (3 A+ 3 a)	3 3 s	3459.05220	3.44E-03	(3.0)	86.65781	3545.71001
(0)P (4 E 2 a)	3 2 s	3372.48700	1.73E-03	(15.0)	184.55302	3557.04002
(0)Q (3 E 2 a)	3 2 s	3451.85800			105.18374	3557.04174
(0)R (2 E 2 a)	3 2 s	3511.45200			45.58728	3557.03928
(0)P (4 E 1 a)	3 1 s	3370.07400			195.61128	3565.68528
(0)Q (3 E 1 a)	3 1 a	3449.40800	1.13E-03	(3.0)	116.27827	3565.68627
(0)R (2 E 1 a)	3 1 a	3508.97600			56.70921	3565.68521
(0)P (5 A+ 3 a)	4 3 s	3349.70000	9.02E-04	(4.3)	265.22662	3614.92662
(0)Q (4 A- 3 a)	4 3 a	3448.83900	1.55E-03	(3.3)	166.08789	3614.92689
(0)R (3 A+ 3 a)	4 3 s	3528.26800	1.80E-03	(15.0)	86.65781	3614.92581
(0)P (5 E 4 a)	4 4 s	3359.56426	3.63E-04	(6.7)	239.40823	3598.97249
(0)Q (4 E 4 a)	4 4 s	3458.80955	1.79E-03	(3.0)	140.16322	3598.97277
(0)P (5 E 2 a)	4 2 s	3343.39943	6.04E-04	(3.0)	283.61666	3627.01609
(0)Q (4 E 2 a)	4 2 s	3442.46415	4.97E-04	(15.6)	184.55302	3627.01717
(0)R (3 E 2 a)	4 2 s	3521.83324	1.09E-03	(7.0)	105.18374	3627.01698
(0)P (5 E 1 a)	4 1 s	3339.77339	2.23E-03	(7.0)	294.62999	3634.40338
(0)Q (4 E 1 a)	4 1 a	3438.79308			195.61128	3634.40436
(0)R (3 E 1 a)	4 1 s	3518.12420	1.33E-03	(7.0)	116.27827	3634.40247
(0)Q (5 A+ 3 a)	5 3 a	3437.36618			265.22662	3702.59280
(0)R (4 A- 3 a)	5 3 a	3536.50476	5.74E-03	(3.3)	166.08789	3702.59265
(0)P (6 E 4 a)	5 4 a	3327.18700			358.28449	3685.47149
(0)Q (5 E 4 a)	5 4 a	3446.06500	8.31E-04	(3.0)	239.40823	3685.47323
(0)R (4 E 4 a)	5 4 s	3545.30900			140.16322	3685.47222
(0)P (6 E 2 a)	5 2 s	3311.99058			402.27775	3714.26833
(0)R (4 E 2 a)	5 2 s	3529.71559	1.08E-02	(3.4)	184.55302	3714.26861
(0)P (6 E 5 a)	5 5 s	3337.80868	3.67E-03	(3.0)	325.12719	3662.93587
(0)Q (5 E 5 a)	5 5 a	3456.84927			206.08743	3662.93670
(0)P (6 E 1 a)	5 1 s	3317.20400	1.26E-02	(5.0)	413.23778	3730.44178
(0)R (4 E 1 a)	5 1 s	3534.83000	2.82E-02	(2.6)	195.61128	3730.44128
(0)P (7 A+ 3 a)	6 3 a	3286.55811	4.47E-04	(4.9)	522.22293	3808.78104
(0)Q (6 A- 3 a)	6 3 s	3424.80364			383.97745	3808.78109
(0)R (5 A+ 3 a)	6 3 a	3543.55382	2.18E-03	(3.8)	265.22662	3808.78044
(0)P (7 A- 6 a)	6 6 s	3320.38132	2.21E-04	(15.0)	423.22281	3743.60413
(0)Q (6 A+ 6 a)	6 6 s	3459.19416	2.56E-03	(4.7)	284.41013	3743.60429
(0)P (7 E 4 a)	6 4 a	3294.30702	5.62E-04	(3.0)	496.67614	3790.98316
(0)R (5 E 4 a)	6 4 s	3551.57431			239.40823	3790.98254
(0)P (7 E 5 a)	6 5 s	3304.90200			463.70701	3768.60901
(0)Q (6 E 5 a)	6 5 a	3443.48200	7.29E-04	(7.0)	325.12719	3768.60919
(0)R (5 E 5 a)	6 5 s	3562.52200			206.08743	3768.60943
(0)P (7 E 1 a)	6 1 s	3278.01700	5.72E-04	(3.0)	551.32034	3829.33734
(0)Q (6 E 1 a)	6 1 a	3416.10000			413.23778	3829.33778
(0)R (5 E 1 a)	6 1 s	3534.70700	9.90E-04	(15.0)	294.62999	3829.33699
(0)Q (7 A- 6 a)	7 6 a	3441.03000	1.10E-03	(4.2)	423.22281	3864.25281
(0)R (6 A+ 6 a)	7 6 a	3579.84200	5.01E-04	(7.0)	284.41013	3864.25213

(I)				(II)		(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(R)P (9,E , 4,a)	8	E	Eo	7	a 5-2	2nu4	3022.49294	36	2.19E-04	3.5	10.0	4
(R)P (8,E , 4,a)	7	E	Eo	4	a 5-2	2nu4	3032.57230	-124	3.21E-04	2.7	5.6	4
(R)P (8,E , 4,a)	7	E	Eo	4	a 5-2	2nu4	3034.13002	1	3.37E-04	3.3	7.4	4
(R)P (7,E , 4,a)	6	E	Eo	2	a 5-2	2nu4	3045.51154	-73	3.73E-04	3.3	4.7	4
(R)P (7,E , 4,a)	6	E	Eo	2	a 5-2	2nu4	3046.53323	26	3.80E-04	2.1	4.2	4
(Q)P (9,A-, 6,a)	8	A-	A2e	3	a 6 0	2nu4	3047.97033	59	5.45E-04	1.4	-7.1	4
**(*)P (9,E , 2,a)	8	E	Ee	13	* * *	**	3050.21313	5	2.58E-04	4.8	26.5	4
(R)P (8,A+, 3,a)	7	A+	A2e	3	a 4-2	2nu4	3050.83293	-180	1.03E-03	1.1	13.2	4
(R)P (8,A-, 3,a)	7	A-	A2o	3	a 4-2	2nu4	3052.97024	-47	1.06E-03	1.7	7.9	4
(Q)P (8,E , 7,a)	7	E	Eo	1	a 7 0	2nu4	3053.75816	100	2.27E-04	0.9	-23.9	4
(Q)P (9,E , 1,a)	8	E	Eo	15	a 1 0	2nu4	3053.94476	-114	3.27E-04	1.8	26.3	4
(Q)P (9,E , 5,a)	8	E	Eo	8	a 5 0	2nu4	3054.06008	-58	3.22E-04	4.8	-5.8	4
(R)P (6,E , 4,a)	5	E	Eo	1	a 5-2	2nu4	3059.45068	-6	2.70E-04	2.8	5.0	4
(Q)P (9,E , 4,a)	8	E	Ee	11	a 4 0	2nu4	3059.79543	-167	3.72E-04	3.6	3.3	4
(R)P (6,E , 4,a)	5	E	Ee	1	a 5-2	2nu4	3060.04591	73	2.75E-04	1.5	4.7	4
(R)P (7,A-, 3,a)	6	A-	A2e	2	a 4-2	2nu4	3063.85845	-114	1.41E-03	4.0	11.8	4
(R)P (7,A+, 3,a)	6	A+	A2o	2	a 4-2	2nu4	3065.36611	-19	1.40E-03	1.4	6.2	4
(Q)P (9,A+, 3,a)	8	A+	A2o	7	a 3 0	2nu4	3066.19411	-224	5.95E-04	1.4	-6.4	4
**(*)P (8,E , 2,a)	7	E	Ee	9	* * *	**	3066.51516	84	5.60E-04	1.8	18.7	4
(Q)P (8,E , 5,a)	7	E	Eo	5	a 5 0	2nu4	3066.93044	66	5.71E-04	2.2	-11.7	4
(Q)P (8,E , 1,a)	7	E	Eo	11	a 1 0	2nu4	3070.72954	26	7.16E-04	2.0	19.3	4
(R)P (8,E , 2,a)	7	E	Ee	10	a 3-2	2nu4	3071.03113	-122	3.99E-04	3.3	-7.0	4
**(N)P (10,A+, 3,a)	9	A+	A2e	11	a 0 0	2nu4	3071.43735	140	6.16E-04	2.0	49.2	4
(Q)P (8,A+, 0,a)	7	A+	A2e	7	a 0 0	2nu4	3071.91136	46	1.44E-03	1.1	13.9	4
(Q)P (8,E , 4,a)	7	E	Ee	8	a 4 0	2nu4	3072.23263	-1	6.84E-04	2.7	-6.1	4
(R)P (9,E , 1,a)	8	E	Ee	18	a 2-2	2nu4	3072.32206	170	3.50E-04	3.2	8.1	4
**(S)P (9,E , 2,a)	8	E	Ee	16	a 4 2	2nu4	3074.20789	105	3.21E-04	1.6	10.7	4
(Q)P (7,A-, 6,a)	6	A-	A2e	1	a 6 0	2nu4	3074.62218	48	9.49E-04	3.4	-22.1	4
(R)P (6,A+, 3,a)	5	A+	A2e	1	a 4-2	2nu4	3077.81075	-68	1.41E-03	2.5	4.4	4
(Q)P (8,A-, 3,a)	7	A-	A2o	6	a 3 0	2nu4	3077.85797	-36	1.08E-03	2.0	-15.2	4
(R)P (6,A-, 3,a)	5	A-	A2o	1	a 4-2	2nu4	3078.80402	26	1.47E-03	1.8	4.9	4
(Q)P (7,E , 5,a)	6	E	Eo	3	a 5 0	2nu4	3080.66466	74	8.39E-04	2.3	-18.7	4
(R)P (7,E , 2,a)	6	E	Eo	6	a 3-2	2nu4	3081.09273	-9	8.78E-04	2.3	-14.3	4
(R)P (8,E , 1,a)	7	E	Ee	13	a 2-2	2nu4	3084.45633	117	5.03E-04	3.4	-6.2	4
(Q)P (7,E , 4,a)	6	E	Ee	5	a 4 0	2nu4	3085.70934	61	1.13E-03	1.7	-13.3	4
(R)P (9,A+, 0,a)	8	A+	A2o	11	a 1-2	2nu4	3087.13347	-105	1.47E-03	1.6	-10.0	4
(Q)P (7,E , 1,a)	6	E	Eo	8	a 1 0	2nu4	3087.70438	69	1.41E-03	1.7	10.8	4
**(O)P (11,E , 2,a)	10	E	Ee	30	a 0 2	2nu4	3088.75001	160	3.11E-04	9.8	22.2	4
**(*)P (11,A+, 0,a)	10	A+	A2o	17	* * *	**	3089.88986	226	8.72E-04	2.1	55.9	4
(Q)P (7,A+, 3,a)	6	A+	A2o	4	a 3 0	2nu4	3090.36251	14	2.49E-03	1.0	-11.5	5
(O)P (10,E , 1,a)	9	E	Ee	26	a 0 2	2nu4	3090.46824	171	2.15E-03	2.5	3.5	4
(Q)P (7,E , 1,a)	6	E	Ee	9	a 1 0	2nu4	3091.69162	182	1.07E-03	2.2	3.4	4
(Q)P (7,A+, 0,a)	6	A+	A2o	6	a 0 0	2nu4	3092.86582	85	2.25E-03	1.4	6.7	5
(R)P (5,A+, 3,a)	4	A+	A2o	1	a 4-2	2nu4	3093.38692	73	9.79E-04	1.1	5.3	4
(R)P (6,E , 2,a)	5	E	Eo	4	a 3-2	2nu4	3095.00042	-32	1.16E-03	2.0	-7.3	4
(R)P (6,E , 2,a)	5	E	Ee	4	a 3-2	2nu4	3096.31991	-57	1.51E-03	3.0	3.1	4
(R)P (7,E , 1,a)	6	E	Ee	10	a 2-2	2nu4	3097.31403	68	8.87E-04	1.8	-10.0	4
**(O)P (11,E , 4,a)	10	E	Ee	26	a 2-2	2nu4	3099.41804	79	3.90E-04	4.2	9.9	4
(R)P (7,E , 1,a)	6	E	Eo	10	a 2-2	2nu4	3099.71083	-208	1.16E-03	0.6	4.8	4
**(S)P (6,E , 2,a)	5	E	Ee	5	a 4 2	2nu4	3100.01376	90	4.33E-04	3.9	-10.3	4
(O)P (6,E , 4,a)	5	E	Ee	3	a 4 0	2nu4	3100.22030	42	1.56E-03	1.6	-20.0	4
**(O)P (10,E , 2,a)	9	E	Ee	26	a 0 2	2nu4	3100.73729	171	4.53E-04	5.3	24.6	4
**(S)P (8,E , 1,a)	7	E	Ee	15	a 3 2	2nu4	3100.99969	-232	2.46E-04	9.5	-11.6	3
(P)P (9,E , 1,a)	8	E	Ee	22	a 0 2	2nu4	3101.84233	169	4.97E-04	3.7	-0.9	3
**(P)P (7,E , 2,a)	6	E	Ee	9	a 1 0	2nu4	3102.02862	182	2.44E-04	5.0	35.7	3
**(Q)P (10,E , 1,a)	9	E	Ee	27	a 1 2	2nu4	3103.12584	-241	7.63E-04	1.5	25.5	3
**(S)P (6,E , 2,a)	5	E	Eo	5	a 4 2	2nu4	3103.26416	64	3.17E-04	2.1	-34.0	3
(O)P (11,E , 4,a)	10	E	Eo	25	a 4 0	nul	3103.42483	-181	3.83E-04	4.4	-37.4	4
**(O)P (11,E , 5,a)	10	E	Eo	22	a 3-2	2nu4	3103.48104	-70	4.81E-04	6.8	16.5	3
(R)P (8,A+, 0,a)	7	A+	A2e	9	a 1-2	2nu4	3103.65370	-146	3.19E-03	2.6	-8.2	4
**(O)P (9,E , 1,a)	8	E	Eo	22	a 1 2	2nu4	3104.19161	-143	8.06E-04	1.4	42.1	4
(Q)P (6,A-, 3,a)	5	A-	A2o	3	a 3 0	2nu4	3104.33308	40	4.02E-03	0.6	-16.4	4
(Q)P (6,E , 1,a)	5	E	Eo	7	a 1 0	2nu4	3104.90936	73	2.41E-03	2.7	-1.5	5
**(N)P (8,A+, 3,a)	7	A+	A2e	7	a 0 0	2nu4	3104.97616	46	1.09E-03	4.2	11.4	3
(Q)P (6,A+, 0,a)	5	A+	A2e	4	a 0 0	2nu4	3105.93068	69	5.25E-03	3.4	-1.4	4
(O)P (11,E , 5,a)	10	E	Ee	22	a 5 0	nul	3106.58895	201	5.26E-04	2.7	-14.5	4
**(*)P (11,A+, 6,a)	10	A+	A2o	8	* * *	**	3107.11316	-123	1.83E-03	1.6	-3.9	4
(O)P (11,E , 7,a)	10	E	Eo	14	a 7 0	nul	3107.21810	-129	9.32E-04	2.3	20.2	4
**(O)P (10,A-, 3,a)	9	A-	A2o	12	a 1-2	2nu4	3107.30663	142	7.15E-04	3.5	3.3	4
(R)Q (10,A-, 9,a)	9	A+	A2o	1	a10-2	2nu4	3107.45580	-245	6.62E-04	1.1	6.7	4
(Q)P (6,E , 1,a)	5	E	Ee	7	a 1 0	2nu4	3108.53753	-200	2.35E-03	1.6	2.1	5
**(*)P (11,E , 7,a)	10	E	Ee	14	* * *	**	3108.72917	6	1.41E-03	2.0	48.4	4
**(O)P (10,E , 2,a)	9	E	Eo	27	a 0 2	2nu4	3108.81574	26	8.05E-04	2.2	26.3	4
**(S)P (8,A+, 0,a)	7	A+	A2e	10	a 2 2	2nu4	3108.93682	-106	1.75E-03	1.5	20.2	4
**(S)P (9,A+, 0,a)	8	A+	A2o	12	a 2 2	2nu4	3109.18228	-32	2.17E-03	1.8	23.8	5
(Q)P (6,E , 2,a)	5	E	Ee	6	a 2 0	2nu4	3109.26242	49	1.70E-03	1.6	-15.5	4
(O)P (11,E , 8,a)	10	E	Ee	10	a 8 0	nul	3109.86545	23	1.14E-03	2.5	3.6	4
(P)P (5,E , 2,a)	4	E	Eo	2	a 3-2	2nu4	3109.93863	-29	1.17E-03	2.5	-5.6	4
(O)P (11,A+, 9,a)	10	A+	A2o	3	a 9 0	nul	3110.61254	-52	1.73E-03	1.7	-30.5	4
(R)P (5,E , 2,a)	4	E	Ee	2	a 3-2	2nu4	3110.85596	7	1.45E-03	1.9	6.9	3
(P)P (6,E , 1,a)	5	E	Ee	8	a 2-2	2nu4	3111.16973	28	9.80E-04	1.6	-5.5	3
**(S)P (11,E , 7,a)	10	E	Eo	15	a 9-1	nu3	3111.23029	-112	2.54E-04	3.0	16.7	3
(O)P (11,E , 8,a)	10	E	Eo	10	a 8 0	nul	3111.49781	23	1.06E-03	3.1	-9.8	3
(O)P (11,E ,10,a)	10	E	Ee	4	a10 0	nul	3111.52900	52	7.58E-04	1.2	-14.4	3
(R)P (7,A+, 0,a)	6	A+	A2o	7	a 1-2	2nu4	3112.01563	-88	5.31E-03	2.5	-11.6	4
**(S)P (11,E , 7,a)	10	E	Ee	15	a 9-1	nu3	3112.38625	-190	4.16E-04	6.5	16.9	3

(I)				(II)		(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(Q)P (11,A-, 9,a)	10	A-	A2e	3	a 9 0	nul	3112.45563	-33	2.15E-03	1.9	-8.3	5
(R)P (6,E , 1,a)	5	E	Eo	8	a 2-2	2nu4	3112.92804	-77	1.55E-03	1.6	3.3	4
(Q)P (11,E ,10,a)	10	E	Eo	4	a10 0	nul	3113.44786	-169	8.08E-04	3.5	-9.4	4
(P)P (8,E , 1,a)	7	E	Ee	17	a 0 2	2nu4	3113.52233	125	1.05E-03	0.5	-1.8	4
**(Q)P (8,E , 1,a)	7	E	Eo	17	a 1 2	2nu4	3115.31248	-83	1.07E-03	0.9	44.7	4
(P)P (9,E , 2,a)	8	E	Eo	22	a 1 2	2nu4	3115.41102	-143	4.16E-04	2.2	-30.2	4
(Q)P (5,E , 4,a)	4	E	Ee	1	a 4 0	2nu4	3115.71504	-29	1.60E-03	0.7	-19.4	4
**(S)P (5,E , 2,a)	4	E	Ee	3	a 4 2	2nu4	3116.68593	-33	3.88E-04	2.8	-10.8	4
(P)P (8,E , 1,a)	7	E	Eo	18	a 0 2	2nu4	3118.85324	88	8.61E-04	3.6	-10.8	4
**(P)P (6,E , 2,a)	5	E	Ee	7	a 1 0	2nu4	3118.88367	-201	3.17E-04	5.5	48.7	4
**(O)P (9,A+, 3,a)	8	A+	A2o	11	a 1-2	2nu4	3118.97330	-188	1.60E-03	3.4	51.5	4
**(S)P (5,E , 2,a)	4	E	Eo	3	a 4 2	2nu4	3119.45419	-116	2.67E-04	9.2	-6.2	4
(Q)P (5,A+, 3,a)	4	A+	A2o	2	a 3 0	2nu4	3119.57017	9	5.25E-03	2.9	-22.0	4
**(O)P (11,A-, 6,a)	10	A-	A2e	10	a 4-2	2nu4	3120.27203	65	2.99E-04	2.5	-60.1	4
(R)Q (9,E , 8,a)	9	E	Eo	1	a 9-2	2nu4	3121.39321	89	5.42E-04	2.9	-4.8	4
(Q)P (5,E , 1,a)	4	E	Eo	5	a 1 0	2nu4	3122.25694	-4	4.43E-03	2.9	1.9	4
**(O)P (10,E , 5,a)	9	E	Ee	18	a 3-2	2nu4	3122.66847	-48	6.37E-04	1.7	-25.0	4
**(Q)P (8,E , 1,a)	7	E	Ee	19	a 1 2	2nu4	3122.73435	-2	1.05E-03	4.7	29.4	3
(Q)P (5,E , 2,a)	4	E	Ee	4	a 2 0	2nu4	3123.13849	26	3.53E-03	1.2	1.6	4
(P)P (9,E , 2,a)	8	E	Ee	23	a 1 2	2nu4	3123.30487	-100	4.46E-04	2.8	-16.9	4
**(O)P (8,E , 2,a)	7	E	Ee	17	a 0 2	2nu4	3123.84395	125	7.19E-04	2.7	36.8	4
**(S)P (6,E , 1,a)	5	E	Ee	9	a 3 2	2nu4	3123.93977	133	8.51E-04	1.9	6.8	4
(Q)P (5,A-, 3,a)	4	A-	A2e	2	a 3 0	2nu4	3124.17491	42	4.94E-03	3.3	-7.4	4
**(*)P (10,A-, 6,a)	9	A-	A2o	6	* * *	**	3124.22150	-5	3.05E-03	2.1	0.2	4
**(N)P (7,A+, 3,a)	6	A+	A2o	6	a 0 0	2nu4	3125.03597	85	2.21E-03	1.2	19.6	5
(R)P (5,E , 1,a)	4	E	Ee	5	a 2-2	2nu4	3125.50177	-193	4.80E-03	2.2	8.5	4
**(N)P (8,E , 4,a)	7	E	Eo	11	a 1 0	2nu4	3125.60567	26	6.79E-04	3.3	4.5	4
**(O)P (9,E , 4,a)	8	E	Ee	18	a 2-2	2nu4	3125.77968	170	3.92E-04	9.1	5.7	4
**(O)P (10,E , 7,a)	9	E	Eo	10	a 5-2	2nu4	3125.84284	-153	1.27E-03	1.3	8.3	4
(R)P (4,E , 2,a)	3	E	Eo	1	a 3-2	2nu4	3125.91783	-19	7.68E-04	3.0	-1.4	4
(P)P (7,E , 1,a)	6	E	Ee	13	a 0 2	2nu4	3126.04165	84	1.93E-03	2.1	-2.7	4
**(O)P (11,E , 7,a)	10	E	Ee	18	a 5-2	2nu4	3126.42590	-73	2.44E-04	4.8	17.9	3
**(*)P (9,E , 5,a)	8	E	Ee	13	* * *	**	3126.45529	6	8.74E-04	4.0	1.3	4
(R)P (4,E , 2,a)	3	E	Ee	1	a 3-2	2nu4	3126.51376	55	8.59E-04	2.7	4.0	4
**(*)P (11,E , 2,a)	10	E	Eo	34	* * *	**	3126.58546	-169	4.76E-04	9.4	19.3	4
**(*)P (11,E , 1,a)	10	E	Ee	36	* * *	**	3126.63346	-101	5.02E-04	7.8	20.1	3
(P)P (8,E , 2,a)	7	E	Eo	17	a 1 2	2nu4	3126.66190	-85	1.65E-03	2.7	25.6	4
**(*)P (11,A+, 0,a)	10	A+	A2o	18	* * *	**	3126.72683	-58	7.36E-04	1.9	-10.3	3
(R)P (5,E , 1,a)	4	E	Eo	6	a 2-2	2nu4	3127.32014	20	1.47E-03	2.4	-8.7	4
(Q)P (5,E , 2,a)	4	E	Eo	4	a 2 0	2nu4	3127.87626	-14	2.92E-03	1.2	-3.6	5
**(*)P (10,E , 7,a)	9	E	Ee	10	* * *	**	3128.74347	178	1.53E-03	2.4	-10.3	4
**(O)P (10,E , 6,a)	9	E	Ee	6	a 6-2	2nu4	3128.92858	-33	1.44E-03	2.9	1.9	4
(P)P (7,E , 1,a)	6	E	Eo	14	a 0 2	2nu4	3130.14910	108	1.37E-03	4.3	-34.7	4
**(O)P (8,E , 2,a)	7	E	Eo	18	a 0 2	2nu4	3130.20276	86	1.39E-03	1.6	48.8	4
(Q)P (10,A-, 9,a)	9	A-	A2o	2	a 9 0	nul	3131.26450	71	2.91E-03	2.7	4.6	5
(Q)P (10,E , 8,a)	9	E	Eo	6	a 8 0	nul	3131.36249	104	1.80E-03	1.6	-0.8	4
**(S)P (6,A+, 0,a)	5	A+	A2e	6	a 2 2	2nu4	3131.74711	31	1.50E-03	1.2	-12.5	4
**(S)P (5,E , 1,a)	4	E	Eo	7	a 3 2	2nu4	3132.57634	54	4.81E-04	2.9	-51.0	4
**(Q)P (7,E , 1,a)	6	E	Ee	14	a 1 2	2nu4	3133.35028	38	1.20E-03	1.3	38.8	4
(Q)P (10,A+, 9,a)	9	A+	A2e	2	a 9 0	nul	3133.37498	-45	2.89E-03	1.8	-9.7	5
**(O)P (10,A-, 9,a)	9	A-	A2o	3	a 7-2	2nu4	3134.64675	55	6.74E-04	3.9	-53.8	4
(Q)P (10,A+, 6,a)	9	A+	A2e	8	a 6 0	nul	3135.08924	52	3.53E-03	3.4	1.3	4
(Q)P (10,E , 7,a)	9	E	Eo	13	a 7 0	nul	3135.26715	99	1.44E-03	4.7	-20.8	3
**(O)P (9,E , 5,a)	8	E	Ee	14	a 3-2	2nu4	3135.63527	-180	2.88E-04	3.3	-59.5	4
(Q)P (4,A-, 3,a)	3	A-	A2o	1	a 3 0	2nu4	3135.93882	-58	4.93E-03	3.3	-23.7	4
(Q)P (10,A-, 3,a)	9	A-	A2o	14	a 3 0	nul	3136.29726	-2	3.30E-03	2.3	-6.9	4
**(O)P (7,E , 2,a)	6	E	Ee	13	a 0 2	2nu4	3136.37845	84	7.26E-04	1.2	39.1	4
(Q)P (10,E , 2,a)	9	E	Ee	30	a 2 0	nul	3136.53623	-4	1.68E-03	1.4	-7.0	4
**(S)P (5,E , 1,a)	4	E	Ee	7	a 3 2	2nu4	3136.60404	82	1.01E-03	0.4	5.1	4
(Q)P (10,A+, 0,a)	9	A+	A2e	16	a 0 0	nul	3136.74947	-5	3.17E-03	4.9	-12.8	4
**(O)P (10,E , 8,a)	9	E	Eo	7	a 6-2	2nu4	3137.44760	-95	1.01E-03	1.0	5.3	4
**(*)P (10,E , 5,a)	9	E	Ee	20	* * *	**	3137.88690	160	2.13E-03	3.2	12.4	4
**(*)P (10,E , 7,a)	9	E	Ee	14	* * *	**	3138.06188	-44	6.39E-04	2.2	-18.1	4
**(O)P (8,E , 4,a)	7	E	Ee	13	a 2-2	2nu4	3138.24469	117	2.80E-04	2.2	-1.3	4
(Q)P (4,E , 2,a)	3	E	Ee	2	a 2 0	2nu4	3138.72365	-10	4.07E-03	1.3	-21.8	4
(P)P (7,E , 2,a)	6	E	Eo	13	a 1 2	2nu4	3138.83131	-67	2.01E-03	2.6	-21.6	5
**(O)P (9,A+, 6,a)	8	A+	A2o	4	a 4-2	2nu4	3139.22864	4	2.75E-03	2.8	-17.8	4
(Q)P (10,E , 4,a)	9	E	Eo	25	a 4 0	nul	3139.43524	74	1.22E-03	2.1	-19.9	4
**(N)P (6,A+, 3,a)	5	A+	A2e	4	a 0 0	2nu4	3139.49991	69	1.66E-03	1.8	-0.5	4
(P)P (6,E , 1,a)	5	E	Ee	11	a 0 2	2nu4	3139.62257	56	3.24E-03	1.8	-0.3	4
(Q)P (10,A+, 3,a)	9	A+	A2e	15	a 3 0	nul	3139.68661	-38	3.27E-03	4.2	4.8	4
(Q)P (4,E , 1,a)	3	E	Eo	3	a 1 0	2nu4	3139.78328	-80	5.96E-03	2.9	-10.5	4
(Q)P (10,E , 2,a)	9	E	Eo	30	a 2 0	nul	3140.03038	15	1.49E-03	2.1	-7.0	4
(Q)P (10,E , 1,a)	9	E	Ee	31	a 1 0	nul	3140.26211	86	1.63E-03	1.8	2.0	4
(P)P (9,A+, 3,a)	8	A+	A2o	12	a 2 2	2nu4	3141.02527	-32	1.12E-03	1.2	-24.0	4
(P)P (9,A+, 6,a)	8	A+	A2o	5	a 5 2	2nu4	3141.51268	38	1.81E-03	1.7	33.7	4
**(O)P (7,E , 2,a)	6	E	Eo	14	a 0 2	2nu4	3141.62426	107	1.44E-03	2.1	53.1	4
(R)P (4,E , 1,a)	3	E	Ee	3	a 2-2	2nu4	3141.80831	-20	3.05E-03	2.6	8.1	5
(P)P (8,A+, 3,a)	7	A+	A2e	10	a 2 2	2nu4	3142.00235	-106	3.55E-03	3.3	9.2	4
(P)P (6,E , 1,a)	5	E	Eo	12	a 0 2	2nu4	3142.66576	105	2.37E-03	1.1	-31.4	5
(R)P (4,E , 1,a)	3	E	Eo	4	a 2-2	2nu4	3142.88588	89	9.51E-04	1.3	-26.1	4
**(N)P (7,E , 4,a)	6	E	Eo	8	a 1 0	2nu4	3142.98875	68	1.46E-03	1.0	23.7	4
**(O)P (9,E , 7,a)	8	E	Ee	7	a 5-2	2nu4	3143.09428	36	4.46E-04	3.3	-48.3	4
(P)P (7,E , 2,a)	6	E	Ee	14	a 1 2	2nu4	3143.68689	38	2.15E-03	1.8	-11.9	5
**(O)P (7,A+, 3,a)	6	A+	A2o	7	a 1-2	2nu4	3144.18553	-88	1.01E-03	1.2	34.9	4
**(O)P (6,E , 1,a)	5	E	Ee	12	a 1 2	2nu4	3145.33726	31	1.21E-03	1.9	48.7	4

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(R)Q (9,E , 7,a)	9 E Eo 2 a 8-2	2nu4	3145.60083	-52	8.48E-04	1.8	5.4	4
**(N)P (7,E , 4,a)	6 E Ee 9 a 1 0	2nu4	3145.77411	182	1.60E-03	1.3	14.8	4
**(S)P (4,E , 1,a)	3 E Eo 5 s 3 2	2nu4	3147.49046	-15	2.74E-04	1.6	-46.3	4
**(O)P (8,A+, 6,a)	7 A+ A2e 3 s 4-2	2nu4	3148.64917	-181	1.20E-03	1.6	45.3	4
**(O)P (6,E , 2,a)	5 E Ee 11 s 0 2	2nu4	3149.96875	55	6.43E-04	1.0	42.8	4
(P)P (9,E , 5,s)	8 E Ee 16 s 4 2	2nu4	3150.44974	105	2.38E-03	1.3	28.6	5
(R)Q (7,A+, 6,s)	7 A- A2o 1 s 7-2	2nu4	3150.55256	168	3.34E-03	3.9	3.4	3
(R)Q (7,A-, 6,a)	7 A+ A2e 1 a 7-2	2nu4	3151.01012	15	3.28E-03	1.9	0.7	4
(P)P (9,E , 7,s)	8 E Ee 9 s 6 2	2nu4	3151.34320	-27	3.98E-03	3.0	14.3	4
**(O)P (8,A-, 6,s)	7 A- A2o 3 a 4-2	2nu4	3152.02723	-47	7.58E-04	1.4	-49.4	4
(P)P (6,E , 2,s)	5 E Eo 11 s 1 2	2nu4	3152.16323	-54	3.46E-03	2.0	-23.4	4
(Q)P (9,E , 8,a)	8 E Ee 5 s 8 0	nu1	3153.34215	94	3.49E-03	0.6	-13.2	4
(Q)P (9,E , 5,a)	8 E Eo 16 s 5 0	nu1	3153.82372	96	5.46E-03	1.9	-7.4	4
(Q)P (9,E , 4,a)	8 E Ee 21 a 4 0	nu1	3154.23199	-89	4.76E-03	2.4	-1.4	4
**(O)P (6,E , 2,s)	5 E Eo 12 a 0 2	2nu4	3154.25582	105	1.57E-03	2.7	64.1	4
(P)P (5,E , 1,s)	4 E Ee 8 s 0 2	2nu4	3154.33494	37	4.66E-03	3.1	-1.1	4
(P)P (10,A-, 9,a)	9 A- A2o 4 a 8 2	2nu4	3154.71771	29	5.00E-03	1.8	15.8	4
(Q)P (9,E , 2,a)	8 E Ee 26 s 2 0	nu1	3154.77563	-63	4.56E-03	4.6	-7.6	3
(Q)P (9,E , 1,a)	8 E Eo 27 s 1 0	nu1	3154.93346	-63	4.65E-03	2.0	-4.6	4
(Q)P (9,E , 8,s)	8 E Eo 5 a 8 0	nu1	3155.12780	-114	4.60E-03	2.4	0.1	4
(Q)P (3,E , 2,s)	2 E Ee 1 s 2 0	2nu4	3155.94642	-78	3.68E-03	3.2	-20.4	4
(Q)P (9,E , 5,s)	8 E Ee 17 a 5 0	nu1	3156.11223	74	3.71E-03	2.6	-14.5	4
(Q)P (9,E , 4,s)	8 E Eo 21 a 4 0	nu1	3156.32562	17	4.46E-03	2.5	-8.4	4
(P)P (5,E , 1,a)	4 E Eo 9 a 0 2	2nu4	3156.52495	87	3.51E-03	2.8	-31.2	4
(Q)P (9,E , 2,s)	8 E Eo 26 a 2 0	nu1	3156.99483	33	4.52E-03	2.0	-5.4	4
(Q)P (9,E , 1,s)	8 E Ee 27 a 1 0	nu1	3157.19669	62	4.28E-03	3.7	-10.3	4
(R)Q (8,A-, 6,s)	8 A+ A2o 1 s 7-2	2nu4	3158.05592	69	2.75E-03	1.3	-3.0	4
**(O)P (6,A-, 3,a)	5 A- A2o 4 s 1-2	2nu4	3158.27130	103	4.07E-04	8.5	-23.8	4
(P)P (9,E , 8,s)	8 E Eo 6 s 7 2	2nu4	3158.62858	-246	3.18E-03	2.8	20.5	4
**(O)P (5,E , 1,s)	4 E Ee 9 a 1 2	2nu4	3158.84296	11	7.83E-04	3.6	45.6	4
**(*)P (7,E , 5,s)	6 E Ee 6 * * *	**	3159.84602	-73	2.24E-03	2.1	-27.7	5
(R)P (11,E , 7,s)	10 E Ee 20 s 8 1	nu3	3160.34200	47	2.65E-04	3.8	16.5	4
**(N)P (6,E , 4,s)	5 E Eo 7 s 1 0	2nu4	3160.56311	73	1.52E-03	1.1	-5.1	4
**(O)P (7,E , 5,s)	6 E Ee 7 a 3-2	2nu4	3161.33071	138	1.72E-03	1.5	39.4	4
(P)P (9,E , 8,a)	8 E Ee 6 a 7 2	2nu4	3161.48690	-213	3.56E-03	2.5	11.7	4
**(O)P (6,A+, 3,s)	5 A+ A2e 5 a 1-2	2nu4	3161.83229	-82	3.56E-04	8.9	-21.7	4
**(O)P (7,A-, 6,a)	6 A- A2e 2 s 4-2	2nu4	3162.25704	-114	5.16E-04	2.8	42.2	4
**(N)P (9,A+, 6,s)	8 A+ A2o 7 s 3 0	2nu4	3164.46720	-224	8.72E-04	1.6	23.8	4
**(O)P (5,E , 2,a)	4 E Ee 8 s 0 2	2nu4	3164.68636	37	4.95E-04	2.1	49.8	4
(R)Q (6,E , 5,a)	6 E Eo 1 a 6-2	2nu4	3165.08203	54	2.49E-03	0.8	-0.5	5
(R)P (11,A-, 6,a)	10 A- A2e 13 a 7 1	nu3	3165.84750	-176	6.59E-04	2.8	14.8	4
(P)P (7,E , 4,a)	6 E Ee 12 a 3 2	2nu4	3166.24075	33	4.14E-03	1.8	10.2	4
(P)P (5,E , 2,s)	4 E Eo 8 s 1 2	2nu4	3166.72679	-40	5.45E-03	2.7	-21.3	4
(P)P (5,E , 2,a)	4 E Ee 9 a 1 2	2nu4	3169.19529	12	6.03E-03	2.6	-9.4	4
(P)P (4,E , 1,a)	3 E Ee 6 s 0 2	2nu4	3170.17266	26	5.73E-03	3.6	-4.5	4
(R)Q (7,E , 5,s)	7 E Ee 2 s 6-2	2nu4	3171.09568	-42	2.41E-03	1.2	1.3	5
(P)P (4,E , 1,a)	3 E Eo 7 a 0 2	2nu4	3171.71884	61	1.46E-02	2.1	59.5	3
(R)Q (7,E , 5,a)	7 E Eo 2 a 6-2	2nu4	3172.05003	14	2.41E-03	1.4	0.2	5
(R)P (11,E , 5,a)	10 E Eo 32 a 6 1	nu3	3172.26607	117	3.59E-04	8.8	7.3	3
(P)P (7,A+, 6,a)	6 A+ A2o 3 a 5 2	2nu4	3172.37109	0	1.77E-02	0.8	9.8	3
(P)P (3,A+, 0,a)	2 A+ A2o 2 a 1-2	2nu4	3173.54776	-10	1.37E-02	2.5	4.8	3
(Q)P (8,A+, 6,a)	7 A- A2e 5 a 6 0	nu1	3173.67630	33	1.91E-02	1.6	-0.7	4
(Q)P (8,A-, 3,a)	7 A- A2o 10 a 3 0	nu1	3173.98239	-65	2.25E-02	4.7	-1.0	6
**(*)P (7,E , 5,a)	6 E Ee 8 * * *	**	3174.10175	54	3.38E-03	2.3	10.1	3
(Q)P (8,A+, 0,a)	7 A+ A2e 12 a 0 0	nu1	3174.26164	-81	2.23E-02	4.3	-1.8	6
**(N)P (4,A+, 3,a)	3 A+ A2e 2 a 0 0	2nu4	3174.41146	-23	8.15E-04	1.4	-4.0	4
(Q)P (8,A-, 6,a)	7 A- A2o 5 a 6 0	nu1	3175.25155	-69	2.10E-02	1.2	0.9	5
(Q)P (8,E , 7,a)	7 E Ee 7 a 7 0	nu1	3175.61384	-87	5.85E-03	3.5	-5.7	4
(Q)P (2,A+, 0,a)	1 A+ A2e 1 a 0 0	2nu4	3176.29494	-94	1.36E-02	1.9	-11.9	3
(R)Q (10,A-, 6,a)	10 A+ A2o 4 a 7-2	2nu4	3176.72061	128	8.42E-04	3.8	5.3	4
**(N)P (5,E , 4,a)	4 E Eo 5 a 1 0	2nu4	3178.23421	-5	1.62E-03	1.5	-6.1	4
(P)P (6,E , 4,a)	5 E Ee 9 a 3 2	2nu4	3178.27916	132	6.05E-03	2.5	-6.8	3
(R)Q (8,E , 5,a)	8 E Ee 4 a 6-2	2nu4	3178.35488	-88	1.45E-03	1.8	-6.1	4
(R)Q (5,E , 4,a)	5 E Eo 1 a 5-2	2nu4	3178.38263	-6	3.46E-03	1.9	-2.7	4
(R)Q (5,E , 4,a)	5 E Ee 1 a 5-2	2nu4	3178.92250	73	3.60E-03	2.6	0.0	4
**(S)P (3,A+, 0,a)	2 A+ A2o 3 a 2 2	2nu4	3179.13068	-37	4.51E-04	3.0	27.5	4
(R)Q (8,E , 5,a)	8 E Eo 4 a 6-2	2nu4	3179.82266	27	1.51E-03	2.5	-2.6	4
**(O)P (5,E , 4,a)	4 E Ee 5 a 2-2	2nu4	3180.06152	-194	1.91E-03	1.8	45.2	4
**(N)P (9,E , 7,a)	8 E Ee 11 a 4 0	2nu4	3180.39688	-167	3.34E-04	3.2	25.0	4
(P)P (5,A+, 3,a)	4 A+ A2o 5 a 2 2	2nu4	3181.93609	144	1.63E-02	1.6	-4.2	4
(R)P (10,E , 7,a)	9 E Eo 16 a 8 1	nu3	3182.06183	-13	3.51E-04	2.8	7.5	4
(R)P (10,E , 7,a)	9 E Ee 16 a 8 1	nu3	3182.34476	28	3.59E-04	2.4	9.1	4
(R)Q (6,E , 4,a)	6 E Eo 2 a 5-2	2nu4	3183.96273	-72	3.67E-03	2.2	-1.4	4
(R)Q (6,E , 4,a)	6 E Ee 2 a 5-2	2nu4	3184.92519	27	3.94E-03	2.4	4.3	4
(R)P (11,A-, 3,a)	10 A+ A2o 20 a 4 1	nu3	3185.04713	-16	8.02E-04	3.8	-7.0	4
(R)P (11,A+, 3,a)	10 A- A2e 18 a 4 1	nu3	3185.16993	-29	8.56E-04	1.8	-0.4	4
**(N)P (6,E , 5,a)	5 E Ee 6 a 2 0	2nu4	3187.17168	49	3.86E-03	1.5	3.5	4
(P)P (6,A-, 6,a)	5 A- A2o 2 a 5 2	2nu4	3187.78250	-126	3.29E-02	3.4	8.3	6
(R)P (10,A-, 6,a)	9 A+ A2e 12 a 7 1	nu3	3187.97225	-17	1.38E-03	2.5	28.3	4
(P)P (3,E , 1,a)	2 E Eo 5 a 0 2	2nu4	3188.18561	32	5.41E-03	3.2	-21.5	4
(R)P (10,A-, 6,a)	9 A- A2o 11 a 7 1	nu3	3188.25673	33	1.08E-03	1.9	8.4	4
**(T)Q (4,A+, 0,a)	4 A- A2e 2 a 3 0	2nu4	3189.39726	41	3.58E-04	3.9	40.4	4
**(N)P (7,A+, 6,a)	6 A+ A2e 4 a 3 0	2nu4	3190.12731	14	2.38E-03	2.1	11.0	5
(R)Q (7,E , 4,a)	7 E Eo 4 a 5-2	2nu4	3190.40790	-124	2.64E-03	1.0	-1.9	5
**(T)Q (5,A-, 0,a)	5 A- A2o 3 a 3 0	2nu4	3190.66935	40	2.22E-04	3.6	-21.0	4
(R)Q (9,E , 5,a)	9 E Eo 7 a 6-2	2nu4	3191.72434	-95	5.05E-04	4.0	0.1	4
(R)Q (7,E , 4,a)	7 E Ee 4 a 5-2	2nu4	3191.90426	1	2.68E-03	1.5	-2.1	5
**(N)P (8,E , 7,s)	7 E Ee 8 s 4 0	2nu4	3193.78905	0	3.29E-04	4.4	18.0	4
(Q)P (7,E , 1,a)	6 E Eo 19 s 1 0	nu1	3194.10820	-65	2.26E-02	3.1	-2.6	6
(Q)P (7,A-, 6,a)	6 A- A2e 4 s 6 0	nu1	3194.21206	135	2.41E-02	3.9	-1.6	6
(R)P (10,E , 5,s)	9 E Ee 28 s 6 1	nu3	3194.42425	100	7.36E-04	1.9	11.7	4
(P)P (4,A-, 3,a)	3 A- A2o 3 a 2 2	2nu4	3194.87814	-55	2.72E-02	3.0	1.6	5
(P)P (5,E , 5,s)	4 E Ee 3 s 4 2	2nu4	3195.03400	-32	1.63E-02	2.8	4.7	4
(Q)P (7,E , 2,s)	6 E Eo 18 a 2 0	nu1	3195.71196	28	2.24E-02	2.3	-3.4	6
(Q)P (7,A+, 6,s)	6 A+ A2o 5 a 6 0	nu1	3196.01714	-60	2.41E-02	2.6	2.3	5
(P)P (5,E , 5,a)	4 E Eo 3 a 4 2	2nu4	3196.30359	-117	1.66E-02	2.5	3.4	4
(R)Q (8,E , 4,s)	8 E Eo 7 s 5-2	2nu4	3197.42882	-157	1.50E-03	1.8	-2.4	4
(R)Q (10,E , 5,s)	10 E Ee 11 s 6-2	2nu4	3198.13865	6	3.59E-04	3.3	4.3	4
(R)P (11,E , 1,a)	10 E Eo 40 a 2 1	nu3	3198.90199	-41	6.21E-04	4.6	12.4	3
(R)P (11,E , 1,s)	10 E Ee 40 s 2 1	nu3	3199.05172	-38	4.92E-04	3.5	-10.8	4
(R)Q (8,E , 4,a)	8 E Ee 7 a 5-2	2nu4	3199.50074	37	1.54E-03	2.1	-0.2	4
(R)P (10,E , 4,s)	9 E Eo 32 s 5 1	nu3	3200.63749	-3	7.94E-04	1.3	0.0	4
(R)Q (10,E , 5,a)	10 E Eo 11 a 6-2	2nu4	3201.05467	89	3.66E-04	2.2	0.9	4
**(N)P (5,E , 5,s)	4 E Ee 4 s 2 0	2nu4	3201.48702	27	2.63E-03	3.4	-2.0	5
(R)Q (6,A-, 3,a)	6 A+ A2o 2 a 4-2	2nu4	3203.61169	-19	8.40E-03	4.7	-4.8	3
(R)P (9,E , 7,a)	8 E Eo 12 a 8 1	nu3	3203.98934	-23	3.21E-04	1.8	8.7	4
(R)P (9,E , 7,s)	8 E Ee 12 s 8 1	nu3	3204.29339	6	3.24E-04	9.7	9.2	4
(P)P (2,E , 1,s)	1 E Ee 2 s 0 2	2nu4	3205.04866	9	5.94E-03	4.8	-4.2	5
(P)P (4,E , 4,a)	3 E Ee 5 a 3 2	2nu4	3205.28535	-28	1.72E-02	0.6	1.3	4
(R)Q (3,E , 2,s)	3 E Eo 1 s 3-2	2nu4	3205.32511	-19	5.93E-03	2.9	-0.8	5
(P)P (2,E , 1,a)	1 E Eo 3 a 0 2	2nu4	3205.84638	3	5.43E-03	4.3	-13.6	4
(R)Q (3,E , 2,a)	3 E Ee 1 a 3-2	2nu4	3205.88287	55	6.00E-03	2.9	-2.1	3
**(S)Q (5,A+, 3,a)	5 A- A2o 2 s 5 2	2nu4	3206.12884	-127	2.36E-04	5.1	54.5	4
(R)P (10,A-, 3,a)	9 A- A2o 16 a 4 1	nu3	3207.02142	38	1.79E-03	1.1	-4.5	4
(R)P (10,A+, 3,s)	9 A+ A2e 18 s 4 1	nu3	3207.19903	-3	1.82E-03	1.6	-3.0	4
**(N)P (7,E , 7,s)	6 E Ee 5 s 4 0	2nu4	3208.13561	60	2.56E-04	9.2	32.2	4
(R)Q (7,A-, 3,s)	7 A+ A2e 3 s 4-2	2nu4	3208.49906	-180	5.37E-03	2.7	-3.5	4
(R)Q (4,E , 2,s)	4 E Eo 2 s 3-2	2nu4	3209.04689	-29	7.00E-03	3.3	-4.9	3
(R)Q (4,E , 2,a)	4 E Ee 2 a 3-2	2nu4	3209.91935	7	7.58E-03	3.7	-0.2	3
(P)P (3,A-, 3,s)	2 A- A2e 2 s 2 2	2nu4	3210.51052	20	3.40E-02	4.4	-1.9	7
(R)Q (7,A+, 3,a)	7 A- A2o 3 a 4-2	2nu4	3210.58419	-47	5.51E-03	2.7	-4.4	5
(Q)Q (8,E , 8,a)	8 E Ee 2 s 8 0	2nu4	3210.97354	163	7.46E-03	4.0	-14.6	3
(P)P (3,A+, 3,a)	2 A+ A2o 3 a 2 2	2nu4	3211.71032	-37	3.34E-02	2.6	-2.3	8
(Q)Q (6,A+, 6,a)	6 A- A2e 1 s 6 0	2nu4	3213.43471	48	2.96E-02	4.0	-13.1	8
(P)P (11,E , 1,a)	10 E Eo 42 a 0 1	nu3	3213.92197	6	6.71E-04	4.4	-7.1	4
(R)P (10,E , 2,s)	9 E Eo 34 s 3 1	nu3	3214.00135	-4	1.04E-03	2.3	-5.0	4
(P)P (11,E , 1,s)	10 E Ee 42 s 0 1	nu3	3214.09308	40	8.07E-04	4.3	10.7	3
(Q)P (6,E , 4,a)	5 E Ee 13 s 4 0	nu1	3214.42619	18	3.12E-02	2.9	-0.3	7
(Q)Q (1,E , 1,a)	1 E Eo 1 s 1 0	2nu4	3215.47387	-96	6.66E-03	2.0	-26.2	3
(Q)Q (2,E , 2,a)	2 E Ee 1 s 2 0	2nu4	3215.54251	-79	1.41E-02	0.5	-15.8	3
**(S)Q (4,E , 2,a)	4 E Ee 3 s 4 2	2nu4	3215.74983	-32	3.38E-04	3.5	-10.4	4
(Q)P (6,E , 1,s)	5 E Ee 15 a 1 0	nu1	3215.91287	28	4.29E-02	3.4	1.5	7
(Q)P (6,E , 2,s)	5 E Eo 14 a 2 0	nu1	3215.93204	21	3.98E-02	3.3	-2.5	7
(Q)P (6,A+, 3,s)	5 A+ A2e 7 a 3 0	nu1	3215.99084	11	7.44E-02	2.6	-1.4	7
(Q)P (6,E , 4,s)	5 E Eo 13 a 4 0	nu1	3216.12386	-8	3.25E-02	3.9	2.2	7
(R)P (9,E , 5,s)	8 E Ee 24 s 6 1	nu3	3216.31571	52	1.22E-03	4.3	14.4	3
(Q)P (6,E , 5,s)	5 E Ee 10 a 5 0	nu1	3216.37571	-43	2.01E-02	2.8	-2.2	6
(Q)Q (2,E , 1,a)	2 E Eo 2 s 1 0	2nu4	3217.09811	-117	5.20E-03	3.8	-2.1	5
(Q)Q (10,A-, 9,a)	10 A+ A2o 2 s 9 0	2nu4	3217.51355	223	4.31E-03	1.5	-1.4	4
(R)Q (8,A-, 3,a)	8 A+ A2o 4 a 4-2	2nu4	3217.77764	5	3.49E-03	3.0	19.3	4
(P)P (2,E , 2,a)	1 E Ee 3 a 1 2	2nu4	3218.19367	-43	1.22E-02	3.0	-1.3	3
(Q)Q (9,E , 8,a)	9 E Ee 3 s 8 0	2nu4	3218.28891	181	3.60E-03	1.5	-2.9	4
**(S)Q (4,E , 2,s)	4 E Eo 3 a 4 2	2nu4	3218.56450	-114	4.90E-04	6.3	45.6	4
(Q)Q (4,A-, 3,a)	4 A+ A2o 2 s 3 0	2nu4	3218.70891	9	2.08E-02	2.2	-11.1	5
(Q)Q (8,E , 7,a)	8 E Eo 3 s 7 0	2nu4	3218.83776	143	5.42E-03	1.8	-6.3	5
(Q)Q (7,A-, 6,a)	7 A+ A2e 2 s 6 0	2nu4	3219.15694	107	1.56E-02	4.5	-5.0	5
(R)Q (6,E , 2,s)	6 E Eo 6 s 3-2	2nu4	3219.28961	-9	4.45E-03	1.6	-2.8	4
(Q)Q (4,E , 4,s)	4 E Eo 1 a 4 0	2nu4	3219.33934	15	1.71E-02	4.1	-10.4	5
(R)P (10,E , 1,a)	9 E Eo 36 a 2 1	nu3	3220.89163	0	1.07E-03	4.1	-17.8	4
(R)P (10,E , 1,s)	9 E Ee 36 s 2 1	nu3	3221.06738	-21	1.18E-03	1.1	-6.7	4
(R)Q (3,E , 1,s)	3 E Ee 3 s 2-2	2nu4	3221.17819	-20	9.13E-03	3.7	-4.1	3
(Q)Q (4,E , 1,a)	4 E Eo 5 s 1 0	2nu4	3221.27540	-5	1.73E-03	1.3	12.1	4
(P)P (11,E , 2,a)	10 E Ee 41 a 1-1	nu3	3221.88740	14	7.43E-04	2.8	-13.9	4
**(S)Q (5,E , 2,s)	5 E Eo 5 a 4 2	2nu4	3221.97447	64	2.74E-04	6.1	-1.7	3
(R)Q (3,E , 1,a)	3 E Eo 4 a 2-2	2nu4	3222.21859	89	7.44E-03	1.0	-1.1	3
(R)Q (10,E , 4,a)	10 E Ee 18 a 5-2	2nu4	3222.92762	-72	2.90E-04	3.9	-1.4	4
(Q)Q (4,A+, 3,s)	4 A- A2e 2 a 3 0	2nu4	3223.35993	41	2.11E-02	4.4	5.3	6
(Q)Q (5,E , 1,a)	5 E Eo 7 s 1 0	2nu4	3223.51647	72	9.03E-04	4.8	23.1	3
(Q)Q (6,E , 4,a)	6 E Ee 5 s 4 0	2nu4	3224.10072	61	5.52E-03	3.0	-21.3	3
(R)Q (4,E , 1,s)	4 E Ee 5 a 2-2	2nu4	3224.56381	-193	6.77E-03	4.9	-24.2	3
(P)P (1,E , 1,a)	0 E Eo 1 a 0 2	2nu4	3224.63466	-18	4.38E-03	2.3	-6.1	4
(Q)Q (7,E , 5,a)	7 E Eo 5 s 5 0	2nu4	3224.91656	66	5.03E-03	3.7	-2.5	4
(Q)Q (8,A+, 6,a)	8 A- A2e 3 s 6 0	2nu4	3225.50221	59	8.53E-03	2.7	11.1	3
(R)Q (7,E , 2,s)	7 E Eo 9 s 3-2	2nu4	3225.70004	174	2.42E-03	2.5	-15.0	5
(Q)Q (9,E , 7,a)	9 E Eo 5 s 7 0	2nu4	3225.85200	41	4.49E-03	1.7	44.2	4
(Q)Q (10,E , 8,a)	10 E Ee 6 s 8 0	2nu4	3225.96776	14	1.61E-03	3.5	6.1	4
**(*)Q (8,E , 2,a)	8 E Ee 13 * * *	**	3226.91307	6	2.22E-04	5.2	21.6	4
(Q)Q (4,E , 2,s)	4 E Eo 4 a 2 0	2nu4	3226.98443	-14	4.12E-03	1.1	7.7	4
(Q)Q (5,E , 1,s)	5 E Ee 7 a 1 0	2nu4	3227.19289	-201	1.79E-03	2.4	34.7	4
(R)P (10,A+, 0,a)	9 A+ A2e 20 a 1 1	nu3	3228.23409	-25	5.26E-03	3.2	-11.5	5
(R)Q (7,E , 2,a)	7 E Ee 10 a 3-2	2nu4	3228.52649	-122	2.15E-03	1.8	-9.1	5
(Q)Q (6,A-, 3,a)	6 A+ A2o 4 s 3 0	2nu4	3228.60821	15	5.69E-03	2.2	-7.2	5

(I)		(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(R)P (9,A+, 3,a)	8 A+ A2o	16 a 4 1	nu3	3228.97503	94	3.31E-03	2.9	-7.7	3
(R)P (9,A-, 3,s)	8 A- A2e	14 s 4 1	nu3	3229.13198	10	3.63E-03	1.7	1.5	4
(R)Q (5,E , 1,s)	5 E Ee	8 s 2-2	2nu4	3229.82573	28	5.61E-03	3.7	0.9	5
(Q)Q (7,E , 4,a)	7 E Ee	8 s 4 0	2nu4	3230.00684	0	3.17E-03	3.2	5.9	4
(P)Q (1,A+, 0,s)	1 A- A2o	1 s 1-2	2nu4	3231.28651	1	2.55E-02	4.7	-5.4	6
(R)Q (5,E , 1,a)	5 E Eo	8 a 2-2	2nu4	3231.53622	-77	5.66E-03	3.3	-9.0	5
(R)P (8,A+, 6,a)	7 A+ A2e	8 a 7 1	nu3	3231.72457	-12	1.28E-03	4.1	14.3	4
(R)P (8,A-, 6,s)	7 A- A2o	8 s 7 1	nu3	3232.03449	-4	1.20E-03	2.5	7.9	4
(Q)Q (9,A-, 6,a)	9 A+ A2e	5 s 6 0	2nu4	3232.39266	-145	3.60E-03	1.6	8.0	4
**(T)Q (8,A-, 3,a)	8 A+ A2o	6 a 6 0	nu1	3233.88378	-103	5.52E-04	3.4	36.3	3
(Q)P (5,E , 1,a)	4 E Eo	12 s 1 0	nu1	3234.60742	-11	6.47E-02	4.6	-0.9	9
(Q)P (5,E , 2,a)	4 E Ee	11 s 2 0	nu1	3234.65451	0	6.03E-02	2.6	0.0	9
(Q)P (5,A+, 3,a)	4 A+ A2o	6 s 3 0	nu1	3234.75163	18	9.95E-02	2.0	-1.3	8
**(*)Q (6,E , 2,a)	6 E Ee	8 * * *	**	3234.83628	53	7.41E-04	2.6	-26.8	3
(Q)P (5,E , 4,a)	4 E Ee	10 s 4 0	nu1	3234.92279	36	3.24E-02	2.2	0.6	8
(R)Q (6,E , 1,s)	6 E Ee	10 s 2-2	2nu4	3235.44842	68	3.57E-03	0.9	-14.7	4
(Q)Q (7,A+, 3,a)	7 A- A2o	6 s 3 0	2nu4	3235.47176	-36	2.38E-03	2.0	-0.2	5
**(S)Q (4,E , 1,s)	4 E Ee	7 a 3 2	2nu4	3235.66530	82	4.61E-04	5.4	24.2	4
(R)P (9,E , 2,a)	8 E Ee	30 a 3 1	nu3	3235.75032	54	2.26E-03	5.0	3.9	5
(R)P (9,E , 2,s)	8 E Eo	30 s 3 1	nu3	3235.95077	11	2.29E-03	3.9	4.9	5
(R)Q (3,A+, 0,s)	3 A- A2o	2 s 1-2	2nu4	3235.99176	32	3.67E-02	3.0	-5.5	9
(R)Q (8,E , 2,a)	8 E Ee	14 a 3-2	2nu4	3236.09358	-179	1.38E-03	4.6	10.1	3
(P)P (10,E , 1,s)	9 E Ee	38 s 0 1	nu3	3236.11523	8	1.95E-03	4.9	11.1	4
(Q)P (5,A+, 0,s)	4 A+ A2o	7 a 0 0	nu1	3236.23251	20	1.33E-01	3.0	-1.7	8
(Q)P (5,E , 1,s)	4 E Ee	12 a 1 0	nu1	3236.25196	18	6.30E-02	4.3	-5.1	7
(Q)P (5,E , 2,s)	4 E Eo	11 a 2 0	nu1	3236.31765	11	6.02E-02	2.6	-1.7	9
(Q)P (5,A-, 3,s)	4 A- A2e	5 a 3 0	nu1	3236.45030	-3	1.00E-01	3.5	-1.9	8
(Q)P (5,E , 4,s)	4 E Eo	10 a 4 0	nu1	3236.68133	-30	3.29E-02	3.6	0.5	8
(Q)Q (8,E , 4,a)	8 E Ee	11 s 4 0	2nu4	3236.80309	-167	1.43E-03	2.0	4.8	4
**(P)Q (5,E , 2,a)	5 E Ee	7 a 1 0	2nu4	3237.54565	-200	2.59E-04	2.9	25.3	4
(R)Q (6,E , 1,a)	6 E Eo	10 a 2-2	2nu4	3237.79356	-207	4.06E-03	4.1	-3.8	4
(R)P (8,E , 5,a)	7 E Eo	20 a 6 1	nu3	3237.82938	14	1.39E-03	2.6	7.1	4
(R)Q (10,A+, 3,s)	10 A- A2e	10 s 4-2	2nu4	3239.40082	65	2.22E-04	2.8	-59.0	4
(R)Q (9,E , 2,s)	9 E Eo	18 s 3-2	2nu4	3239.56173	-39	4.14E-04	3.0	-14.5	4
(R)Q (7,E , 1,s)	7 E Ee	13 s 2-2	2nu4	3241.93632	117	2.11E-03	1.2	-16.3	4
**(*)Q (7,E , 2,a)	7 E Ee	11 * * *	**	3242.20815	-15	8.05E-04	2.6	44.8	4
**(S)Q (5,E , 1,s)	5 E Ee	9 a 3 2	2nu4	3242.59409	132	3.00E-04	0.4	1.8	3
(R)P (9,E , 1,a)	8 E Eo	32 a 2 1	nu3	3242.82625	36	2.94E-03	3.3	11.6	5
(P)P (10,E , 2,a)	9 E Ee	37 a 1-1	nu3	3243.87039	-15	1.87E-03	4.5	-10.4	4
(R)P (8,E , 4,a)	7 E Ee	24 a 5 1	nu3	3244.14196	21	2.19E-03	2.2	4.8	5
(R)P (8,E , 4,s)	7 E Eo	24 s 5 1	nu3	3244.38722	-24	2.94E-03	4.7	28.8	3
(R)Q (5,A+, 0,s)	5 A- A2o	4 s 1-2	2nu4	3244.60738	103	2.44E-02	3.3	-3.8	5
(P)Q (1,E , 1,s)	1 E Ee	2 s 0 2	2nu4	3244.81452	10	5.98E-03	2.7	-8.6	4
(P)Q (1,E , 1,a)	1 E Eo	3 a 0 2	2nu4	3245.59228	3	5.72E-03	2.6	-13.1	4
(P)Q (2,E , 1,s)	2 E Ee	4 s 0 2	2nu4	3246.69201	17	8.30E-03	3.7	-7.4	3
(R)Q (8,E , 1,s)	8 E Ee	18 s 2-2	2nu4	3248.99834	169	1.12E-03	3.0	-12.0	4
(P)Q (3,E , 1,s)	3 E Ee	6 s 0 2	2nu4	3249.54222	26	8.71E-03	4.6	-7.0	3
(R)P (8,A+, 3,a)	7 A+ A2e	14 s 4 1	nu3	3250.97275	9	5.77E-03	4.7	-1.3	4
(P)Q (3,E , 1,a)	3 E Eo	7 a 0 2	2nu4	3251.05198	61	8.00E-03	3.1	-15.9	3
(P)P (10,A-, 3,s)	9 A- A2o	17 a 2-1	nu3	3251.82207	-142	4.64E-03	3.1	-8.3	4
**(R)Q (5,E , 2,a)	5 E Ee	9 a 3 2	2nu4	3252.94751	133	2.08E-04	0.6	14.0	4
**(N)Q (3,A-, 3,s)	3 A+ A2e	2 s 0 0	2nu4	3253.87778	-26	4.20E-04	6.4	32.9	4
(Q)P (4,A+, 0,a)	3 A+ A2e	6 s 0 0	nu1	3254.92268	5	1.01E-01	2.2	-1.9	8
(Q)P (4,E , 1,a)	3 E Eo	9 s 1 0	nu1	3254.94642	9	8.46E-02	4.2	-3.9	9
(Q)P (4,E , 2,a)	3 E Ee	8 s 2 0	nu1	3255.02334	19	7.36E-02	3.6	-1.0	9
(Q)P (4,A-, 3,a)	3 A- A2o	4 s 3 0	nu1	3255.16810	32	9.43E-02	2.9	-0.9	9
(Q)P (4,E , 1,s)	3 E Ee	9 a 1 0	nu1	3256.63110	6	8.90E-02	4.0	-0.3	9
(Q)P (4,E , 2,s)	3 E Eo	8 a 2 0	nu1	3256.73201	-3	7.47E-02	2.9	-1.1	9
(Q)R (1,E , 1,a)	2 E Eo	2 s 1 0	2nu4	3256.84374	-117	5.13E-03	2.4	-48.4	5
(Q)P (4,A+, 3,s)	3 A+ A2e	5 a 3 0	nu1	3256.92089	-22	9.50E-02	3.1	-1.7	9
(R)P (8,E , 2,a)	7 E Ee	26 a 3 1	nu3	3257.58333	88	3.74E-03	3.8	-1.5	4
(R)P (8,E , 2,s)	7 E Eo	26 s 3 1	nu3	3257.79235	14	3.91E-03	2.9	2.7	4
(P)P (9,E , 1,a)	8 E Eo	34 a 0 1	nu3	3257.86379	11	3.54E-03	3.3	-5.5	4
(P)P (9,E , 1,s)	8 E Ee	34 s 0 1	nu3	3258.09778	0	3.56E-03	1.9	-5.1	4
(P)Q (5,E , 1,s)	5 E Ee	11 s 0 2	2nu4	3258.27835	55	5.41E-03	4.1	-11.3	5
**(N)Q (5,A-, 3,s)	5 A+ A2e	4 s 0 0	2nu4	3258.30198	69	1.02E-03	2.7	-22.2	4
(P)Q (2,E , 2,s)	2 E Eo	4 a 1 2	2nu4	3259.01972	-19	5.09E-03	3.2	-14.8	4
(R)P (7,E , 5,a)	6 E Eo	16 a 6 1	nu3	3259.50023	-3	1.05E-03	0.9	6.5	4
(R)P (7,E , 5,s)	6 E Ee	16 s 6 1	nu3	3259.81805	-15	1.02E-03	2.3	3.5	4
(P)Q (2,E , 2,a)	2 E Ee	5 a 1 2	2nu4	3260.15732	-28	5.44E-03	3.5	-6.9	5
**(R)Q (6,E , 2,a)	6 E Ee	12 a 3 2	2nu4	3260.63726	32	3.29E-04	6.4	20.6	4
(P)P (10,E , 4,a)	9 E Ee	35 a 3-1	nu3	3260.71936	-40	3.08E-03	1.0	-0.9	4
(P)P (10,E , 4,s)	9 E Eo	35 s 3-1	nu3	3261.00447	2	3.13E-03	3.2	0.5	4
(P)Q (5,E , 1,a)	5 E Eo	12 a 0 2	2nu4	3261.27355	105	5.11E-03	3.8	-16.5	5
(P)Q (3,E , 2,s)	3 E Eo	6 s 1 2	2nu4	3261.89933	-28	6.85E-03	2.6	-11.0	3
**(N)Q (7,A-, 3,s)	7 A+ A2e	7 s 0 0	2nu4	3262.64279	46	6.39E-04	1.0	-47.0	4
**(N)Q (6,A-, 3,a)	6 A+ A2o	6 s 0 0	2nu4	3263.28117	85	1.77E-03	2.4	10.3	4
(P)Q (6,E , 1,s)	6 E Ee	13 s 0 2	2nu4	3264.17604	84	3.59E-03	2.2	-8.6	4
(R)P (8,E , 1,a)	7 E Eo	28 a 2 1	nu3	3264.65779	60	4.63E-03	2.1	-2.8	4
(R)P (8,E , 1,s)	7 E Ee	28 s 2 1	nu3	3264.88197	2	4.81E-03	2.6	0.9	4
(R)R (2,E , 2,s)	3 E Eo	1 s 3-2	2nu4	3264.95160	-18	1.69E-02	1.9	-0.9	4
(R)R (2,E , 2,a)	3 E Ee	1 a 3-2	2nu4	3265.47959	55	1.59E-02	4.1	-4.6	4
(R)P (7,E , 4,s)	6 E Eo	20 s 5 1	nu3	3266.03936	-83	2.66E-03	4.7	10.7	5
(P)P (9,E , 2,s)	8 E Eo	33 s 1-1	nu3	3266.09814	-11	4.40E-03	1.8	-3.2	4
(P)P (11,E , 7,s)	10 E Ee	33 s 6-1	nu3	3266.70270	108	3.11E-03	4.1	13.9	3
(P)Q (6,E , 1,a)	6 E Eo	14 a 0 2	2nu4	3268.23133	107	3.38E-03	2.3	-13.1	4

(I)		(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
**(R)Q (7,E , 2,a)	7 E Ee	15 a 3 2	2nu4	3268.81679	-231	3.02E-04	2.7	10.1	4
(P)P (10,E , 5,a)	9 E Eo	33 a 4-1	nu3	3269.61112	-78	1.83E-03	2.0	-2.9	4
(P)P (10,E , 5,s)	9 E Ee	33 s 4-1	nu3	3269.95638	0	3.78E-03	1.3	-4.6	4
(P)Q (5,E , 2,a)	5 E Eo	11 a 1 2	2nu4	3270.87395	-54	5.01E-03	3.0	-8.3	5
(P)Q (7,E , 1,s)	7 E Ee	17 s 0 2	2nu4	3271.00223	125	2.12E-03	3.1	-4.2	5
**(O)Q (3,A-, 3,s)	3 A+ A2e	3 a 1-2	2nu4	3271.23832	-24	3.01E-04	4.5	62.9	4
(R)Q (9,A+, 0,a)	9 A- A2o	12 a 1-2	2nu4	3271.35524	142	1.90E-03	2.3	-8.7	4
(R)R (3,A-, 3,a)	4 A- A2e	1 a 4-2	2nu4	3271.44070	-24	3.74E-02	1.9	-2.9	9
(R)P (8,A+, 0,a)	7 A+ A2e	16 a 1 1	nu3	3272.04162	46	2.30E-02	4.1	-2.3	6
(R)P (7,A+, 3,a)	6 A+ A2o	12 a 4 1	nu3	3272.37685	30	8.23E-03	4.4	3.8	3
(R)P (7,A-, 3,s)	6 A- A2e	10 s 4 1	nu3	3272.66371	-2	8.44E-03	4.3	5.9	3
(R)R (1,A+, 0,a)	2 A+ A2o	2 a 1-2	2nu4	3272.89588	-10	2.22E-02	2.5	-7.7	6
(P)Q (3,A-, 3,a)	3 A+ A2e	4 s 2 2	2nu4	3273.51094	34	7.99E-03	2.7	-11.1	3
(P)Q (5,E , 2,s)	5 E Ee	12 s 1 2	2nu4	3274.34519	32	4.84E-03	4.5	-8.2	4
(Q)P (3,E , 1,a)	2 E Eo	7 a 1 0	nu1	3275.23627	22	9.61E-02	3.7	-1.5	8
(Q)P (3,E , 2,a)	2 E Ee	6 a 2 0	nu1	3275.33629	30	6.49E-02	3.3	0.7	9
(P)Q (7,E , 1,a)	7 E Eo	18 a 0 2	2nu4	3276.27808	86	1.90E-03	0.7	-12.3	4
(Q)P (3,E , 1,s)	2 E Ee	7 a 1 0	nu1	3276.96240	-5	9.75E-02	2.1	-1.7	8
(P)Q (6,E , 2,s)	6 E Eo	13 s 1 2	2nu4	3277.02772	-67	3.74E-03	1.1	5.7	4
(Q)P (3,E , 2,s)	2 E Eo	6 a 2 0	nu1	3277.06994	-17	6.52E-02	3.2	-0.5	9
**(N)Q (4,E , 4,s)	4 E Eo	5 s 1 0	2nu4	3277.52938	-4	3.59E-04	3.9	-3.4	4
(R)R (4,E , 4,s)	5 E Ee	1 a 5-2	2nu4	3278.16744	73	1.76E-02	3.8	-5.1	3
(P)Q (8,E , 1,s)	8 E Ee	22 s 0 2	2nu4	3278.51868	168	9.57E-04	2.5	-15.6	3
(P)P (10,A-, 6,s)	9 A- A2o	15 s 5-1	nu3	3279.24708	-5	9.96E-03	3.2	-2.9	3
(Q)R (2,A+, 0,a)	3 A+ A2e	2 s 0 0	2nu4	3279.32962	-22	3.33E-02	2.7	-11.0	8
(P)P (8,E , 1,s)	7 E Ee	30 s 0 1	nu3	3279.98901	0	7.09E-03	2.7	-2.4	3
**(O)Q (5,A-, 3,a)	5 A+ A2e	5 a 1-2	2nu4	3280.63333	-82	9.97E-04	2.5	32.9	4
(R)R (2,E , 1,s)	3 E Ee	3 s 2-2	2nu4	3280.77645	-19	5.49E-03	2.6	-33.3	5
(P)Q (4,A-, 3,s)	4 A+ A2o	5 a 2 2	2nu4	3281.07480	144	9.02E-03	4.0	-9.0	3
**(N)Q (5,E , 4,s)	5 E Ee	7 a 1 0	2nu4	3281.75316	-201	6.24E-04	3.5	-7.6	4
(P)Q (6,E , 2,a)	6 E Ee	14 a 1 2	2nu4	3281.83071	37	2.99E-03	1.6	-10.8	5
**(O)Q (4,E , 4,s)	4 E Eo	6 a 2-2	2nu4	3282.59234	20	3.83E-04	2.3	45.1	4
**(N)Q (7,E , 4,a)	7 E Eo	11 s 1 0	2nu4	3283.44115	26	2.53E-04	3.7	-59.0	4
(P)Q (5,A+, 3,a)	5 A- A2o	5 a 2 2	2nu4	3283.52767	-165	8.67E-03	2.7	-9.7	3
**(L)P (11,A-, 9,s)	10 A- A2e	10 s 4-2	2nu4	3283.69882	65	3.77E-03	4.1	41.6	4
**(N)Q (6,E , 4,s)	6 E Ee	9 a 1 0	2nu4	3284.16564	182	6.27E-04	3.6	-2.4	3
(P)Q (7,E , 2,a)	7 E Eo	17 s 1 2	2nu4	3284.21467	-83	2.20E-03	4.7	10.2	4
**(O)Q (5,E , 4,s)	5 E Ee	8 s 2-2	2nu4	3284.38529	27	4.37E-04	1.7	-4.3	4
(P)Q (9,E , 1,a)	9 E Ee	26 s 0 2	2nu4	3286.17970	171	4.91E-04	5.2	4.9	5
**(S)R (2,E , 1,s)	3 E Eo	5 s 3 2	2nu4	3286.39250	-15	1.24E-03	3.8	26.7	4
(P)R (1,E , 1,a)	2 E Ee	4 a 0 2	2nu4	3286.45780	17	1.68E-03	2.2	-9.7	4
(R)P (7,E , 1,a)	6 E Ee	24 s 2 1	nu3	3286.59573	1	7.71E-03	3.1	0.7	3
(R)P (6,E , 4,a)	5 E Ee	16 a 5 1	nu3	3287.31506	0	1.82E-03	1.5	8.9	4
(R)P (6,E , 4,s)	5 E Eo	16 s 5 1	nu3	3287.64377	-26	1.88E-03	3.2	11.4	4
(P)P (8,E , 2,a)	7 E Ee	29 a 1-1	nu3	3287.73510	9	8.48E-03	4.2	-5.7	3
(P)Q (4,E , 4,s)	4 E Eo	7 s 3 2	2nu4	3287.84852	54	2.41E-03	1.9	-15.5	5
(P)P (8,E , 2,s)	7 E Eo	29 s 1-1	nu3	3288.01871	-9	8.79E-03	3.0	-2.3	3
(R)R (6,A-, 6,s)	7 A- A2o	1 s 7-2	2nu4	3289.43717	168	2.50E-02	4.8	-2.2	7
**(S)R (2,E , 1,a)	3 E Ee	5 a 3 2	2nu4	3289.50972	-28	1.62E-03	4.2	-2.4	3
(R)R (6,A+, 6,a)	7 A+ A2e	1 a 7-2	2nu4	3289.82258	15	2.58E-02	2.7	1.6	6
(P)Q (7,E , 2,a)	7 E Ee	19 a 1 2	2nu4	3290.55157	-2	1.04E-03	2.4	2.8	4
(P)P (9,E , 5,a)	8 E Eo	29 a 4-1	nu3	3291.71219	-80	8.55E-03	4.2	-4.6	3
(P)Q (8,E , 2,s)	8 E Ee	22 s 1 2	2nu4	3292.16587	-143	9.93E-04	0.9	4.1	4
**(O)Q (6,E , 4,a)	6 E Eo	10 a 2-2	2nu4	3293.44695	-208	1.15E-03	2.1	39.0	4
(P)Q (5,E , 4,s)	5 E Eo	9 a 3 2	2nu4	3293.55135	133	2.25E-03	0.7	-24.8	5
**(M)P (11,E ,10,a)	10 E Ee	14 a 7 0	nu1	3293.82809	-128	2.20E-03	1.2	10.7	5
(R)P (6,A-, 3,a)	5 A- A2o	8 a 4 1	nu3	3293.87801	24	9.26E-03	4.7	10.5	4
(R)P (7,A+, 0,a)	6 A+ A2o	14 a 1 1	nu3	3294.01148	1	4.02E-02	3.1	1.4	9
**(O)Q (7,A-, 3,s)	7 A+ A2e	9 a 1-2	2nu4	3294.38480	-146	1.08E-03	2.2	10.9	4
**(S)R (3,E , 2,a)	4 E Eo	3 a 4 2	2nu4	3295.11893	-32	2.71E-03	1.2	-19.9	5
(Q)P (2,A+, 0,a)	1 A+ A2e	3 s 0 0	nu1	3295.38775	27	1.97E-01	2.2	-3.1	8
(Q)P (2,E , 1,a)	1 E Eo	4 a 1 0	nu1	3295.42525	29	7.71E-02	3.7	-0.6	9
(P)P (8,A-, 3,a)	7 A- A2o	13 a 2-1	nu3	3295.96483	-40	2.28E-02	3.8	1.5	6
**(O)Q (7,E , 4,a)	7 E Ee	13 a 2-2	2nu4	3296.01864	117	6.37E-04	3.9	16.0	4
(P)Q (5,E , 5,a)	5 E Ee	5 a 4 2	2nu4	3297.02276	90	1.33E-03	2.9	-15.5	4
(P)Q (5,E , 4,a)	5 E Ee	9 a 3 2	2nu4	3297.15535	132	2.34E-03	1.5	-11.2	3
(Q)P (2,E , 1,s)	1 E Ee	4 a 1 0	nu1	3297.18610	-15	7.87E-02	3.1	-0.1	7
(P)P (11,E ,10,a)	10 E Ee	15 a 9-1	nu3	3297.63350	-190	4.72E-03	3.5	-4.6	4
(P)P (11,E ,10,s)	10 E Eo	15 s 9-1	nu3	3297.83782	-114	6.29E-03	1.4	11.7	3
**(S)R (3,E , 2,s)	4 E Eo	3 s 4 2	2nu4	3297.96926	-116	2.44E-03	1.0	10.8	5
**(M)P (9,E , 8,a)	8 E Ee	17 a 5 0	nu1	3298.05055	73	2.25E-04	2.5	46.2	3
(Q)R (3,A+, 3,a)	4 A+ A2o	2 a 3 0	2nu4	3298.13897	9	2.23E-02	3.6	-1.5	5
(Q)R (5,E , 5,a)	5 E Eo	5 a 4 2	2nu4	3298.82401	63	1.54E-03	4.6	6.3	4
(P)Q (7,A-, 3,a)	7 A+ A2e	10 s 2 2	2nu4	3299.66822	-106	2.76E-03	1.5	-1.7	5
(R)R (8,E , 8,s)	9 E Eo	1 s 9-2	2nu4	3299.77536	89	6.24E-03	2.6	0.8	3
**(O)Q (6,E , 5,s)	6 E Ee	7 a 3-2	2nu4	3299.97495	138	1.68E-03	2.2	-8.9	4
(P)Q (8,E , 2,a)	8 E Ee	23 a 1 2	2nu4	3300.00429	-100	7.67E-04	2.1	-7.5	4
**(N)P (10,A+, 9,a)	9 A+ A2e	8 a 6 0	nu1	3300.05918	52	1.26E-03	1.6	36.0	4
**(T)Q (9,A+, 0,s)	9 A- A2o	14 a 3 0	nu1	3300.34774	-1	2.73E-04	7.6	1.5	3
**(T)Q (8,A+, 0,a)	8 A- A2e	12 a 3 0	nu1	3300.52424	24	2.53E-04	9.2	-48.7	4
(Q)R (3,E , 1,s)	4 E Eo	5 s 1 0	2nu4	3300.60873	-4	1.40E-02	2.9	-15.3	3
(Q)R (3,E , 2,a)	4 E Ee	4 s 2 0	2nu4	3301.57209	27	1.65E-02	5.0	3.6	6
(P)P (7,E , 1,a)	6 E Ee	26 s 0 1	nu3	3301.74179	-2	1.38E-02	4.5	8.3	4
**(O)Q (8,E , 4,s)	8 E Ee	18 s 2-2	2nu4	3302.78660	169	6.65E-04	2.4	12.1	4
(Q)R (3,A-, 3,a)	4 A- A2e	2 s 3 0	2nu4	3302.83005	42	1.94E-02	3.3	-0.2	5
(R)R (3,E , 1,s)	4 E Ee	5 s 2-2	2nu4	3303.93322	-194	7.79E-04	2.1	65.5	4

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
**(O)Q (6,A-, 6,a)	6 A+ A2o 2 a 4-2	2nu4	3304.01453	-19	9.88E-04	2.6	17.8	4
(P)Q (6,E , 4,a)	6 E Ee 12 a 3 2	2nu4	3304.63128	32	1.76E-03	1.7	-5.5	4
(P)P (8,E , 4,a)	7 E Eo 27 a 3-1	nu3	3305.09065	-19	1.53E-02	3.8	6.5	5
(R)R (9,A+, 9,a)	10 A+ A2o 1 a10-2	2nu4	3305.44094	-245	8.22E-03	2.6	7.1	4
**(O)Q (7,E , 5,a)	7 E Ee 10 a 3-2	2nu4	3305.93505	-122	1.79E-03	2.7	16.1	4
**(N)Q (5,E , 5,a)	5 E Ee 6 a 2 0	2nu4	3306.26718	45	4.87E-04	5.7	-12.4	4
**(O)Q (7,A-, 6,a)	7 A+ A2e 3 a 4-2	2nu4	3306.89780	-180	1.48E-03	1.5	-14.4	4
(R)P (6,E , 1,a)	5 E Eo 20 a 2 1	nu3	3307.76534	-22	1.21E-02	0.5	12.4	3
(P)R (2,E , 1,a)	3 E Ee 6 a 0 2	2nu4	3309.12843	14	4.54E-03	3.5	39.1	3
(P)P (7,E , 2,a)	6 E Eo 25 a 1-1	nu3	3309.49095	22	1.66E-02	2.4	3.9	4
(P)P (10,A+, 9,a)	9 A+ A2e 9 a 8-1	nu3	3309.53858	176	2.49E-02	1.7	-3.7	5
(R)R (6,E , 5,a)	7 E Ee 2 a 6-2	2nu4	3309.74091	-41	9.06E-03	2.9	8.4	3
(P)P (7,E , 2,a)	6 E Eo 25 a 1-1	nu3	3309.80167	-9	1.71E-02	1.7	6.4	4
**(O)Q (7,A+, 6,a)	7 A- A2o 3 a 4-2	2nu4	3310.34874	-47	2.49E-03	1.3	13.6	5
(P)P (9,E , 7,a)	8 E Eo 25 a 6-1	nu3	3310.71992	-83	1.69E-02	3.1	7.1	4
**(S)R (3,E , 1,a)	4 E Eo 7 a 3 2	2nu4	3310.92830	54	3.61E-03	1.9	19.2	4
(P)P (9,E , 7,a)	8 E Ee 25 a 6-1	nu3	3311.18615	-7	1.78E-02	3.9	11.2	3
(P)Q (6,A-, 6,a)	6 A+ A2o 3 a 5 2	2nu4	3311.25460	0	1.47E-03	2.8	-29.8	4
**(O)Q (7,E , 7,a)	7 E Eo 4 a 5-2	2nu4	3311.33608	-124	6.78E-04	3.2	-6.8	4
(P)Q (7,E , 4,a)	7 E Ee 15 a 3 2	2nu4	3312.56232	-231	1.02E-03	1.5	-0.1	3
**(*)Q (6,E , 5,a)	6 E Ee 8 * * *	**	3312.74450	52	5.22E-04	4.2	-21.9	3
**(O)Q (8,E , 5,a)	8 E Ee 14 a 3-2	2nu4	3312.94401	-180	2.43E-03	3.7	16.0	4
(P)P (8,E , 5,a)	7 E Eo 25 a 4-1	nu3	3313.75485	-53	1.94E-02	2.5	5.2	4
(R)R (4,E , 2,a)	5 E Ee 4 a 3-2	2nu4	3314.04456	-57	4.59E-03	0.4	-24.7	3
(P)P (8,E , 5,a)	7 E Ee 25 a 4-1	nu3	3314.14993	-26	1.97E-02	2.2	6.0	5
(R)P (6,A+, 0,a)	5 A+ A2e 12 a 1 1	nu3	3315.28887	76	6.00E-02	3.3	2.5	8
(Q)P (1,A+, 0,a)	0 A+ A2o 2 a 0 0	nu1	3317.20623	-18	1.26E-01	5.0	-4.7	8
(P)P (7,A+, 3,a)	6 A+ A2o 13 a 2-1	nu3	3317.92046	20	4.19E-02	3.8	2.7	9
(P)P (7,A-, 3,a)	6 A- A2e 11 a 2-1	nu3	3318.14574	-34	4.35E-02	2.5	5.9	9
(R)R (3,A+, 0,a)	4 A+ A2o 4 a 1-2	2nu4	3319.06158	-41	2.23E-02	4.3	5.0	5
(P)P (10,E ,10,a)	9 E Ee 11 a 9-1	nu3	3319.15074	-220	2.21E-02	3.2	17.8	5
(P)P (10,E ,10,a)	9 E Eo 12 a 9-1	nu3	3319.79795	96	2.27E-02	4.0	20.2	5
(P)P (9,E , 8,a)	8 E Ee 20 a 7-1	nu3	3320.76494	-81	2.49E-02	3.4	13.1	5
(R)R (5,A-, 3,a)	6 A- A2e 2 a 4-2	2nu4	3320.96375	-114	1.22E-02	2.0	-11.6	3
(P)P (9,E , 8,a)	8 E Eo 20 a 7-1	nu3	3321.33308	49	2.53E-02	3.5	14.2	5
(Q)R (4,A-, 3,a)	5 A- A2o 3 a 3 0	2nu4	3322.22331	40	3.23E-02	2.0	2.1	8
(P)P (8,A+, 6,a)	7 A+ A2e 13 a 5-1	nu3	3323.15928	-42	5.31E-02	3.5	8.3	8
(P)P (6,E , 1,a)	5 E Ee 22 a 0 1	nu3	3323.31824	-7	2.06E-02	3.9	5.0	6
(Q)R (4,A+, 0,a)	5 A+ A2e 4 a 0 0	2nu4	3323.52443	69	3.70E-02	2.3	-1.3	9
(P)P (8,A-, 6,a)	7 A- A2o 11 a 5-1	nu3	3323.59404	-9	5.35E-02	3.7	8.6	8
(Q)Q (10,E , 8,a)	10 E Ee 10 a 8 0	nu1	3326.33644	23	1.24E-02	3.5	4.0	4
**(O)Q (9,E , 8,a)	9 E Ee 6 a 6-2	2nu4	3326.40049	-32	1.88E-02	3.1	2.0	4
(P)P (7,E , 4,a)	6 E Ee 23 a 3-1	nu3	3326.58799	-9	2.57E-02	0.4	-2.3	3
(P)P (7,E , 4,a)	6 E Eo 23 a 3-1	nu3	3326.95807	-22	2.09E-02	2.2	8.6	8
(Q)R (4,E , 2,a)	5 E Ee 6 a 2 0	2nu4	3326.98822	50	4.02E-02	3.3	65.1	9
(Q)Q (9,E , 8,a)	9 E Eo 6 a 8 0	nu1	3328.92716	104	2.58E-02	4.4	7.4	7
(Q)Q (9,A+, 9,a)	9 A- A2o 2 a 9 0	nu1	3329.24954	72	9.40E-02	3.4	1.7	8
(R)P (5,E , 1,a)	4 E Ee 16 a 2 1	nu3	3329.46540	-19	1.38E-02	4.4	10.7	4
(Q)Q (10,A+, 9,a)	10 A- A2e 3 a 9 0	nu1	3329.58344	-33	4.45E-02	4.1	-5.3	8
(Q)Q (8,A+, 6,a)	8 A- A2e 6 a 6 0	nu1	3331.03810	-74	6.59E-02	3.9	-7.1	9
(Q)Q (8,E , 7,a)	8 E Eo 9 a 7 0	nu1	3331.17804	200	4.07E-02	4.3	-20.1	7
(P)P (6,E , 2,a)	5 E Eo 21 a 1-1	nu3	3331.41024	-10	2.76E-02	3.7	7.1	8
(Q)Q (9,A-, 9,a)	9 A+ A2e 2 a 9 0	nu1	3331.46958	-44	1.11E-01	2.7	4.1	8
(Q)Q (7,E , 5,a)	7 E Eo 13 a 5 0	nu1	3331.71417	-48	5.08E-02	4.5	-3.0	8
(Q)Q (6,E , 2,a)	6 E Ee 18 a 2 0	nu1	3332.21202	-54	1.36E-02	4.0	5.6	4
(Q)Q (7,E , 7,a)	7 E Eo 7 a 7 0	nu1	3332.34886	10	1.59E-01	2.7	-1.1	8
(Q)Q (6,E , 4,a)	6 E Eo 15 a 4 0	nu1	3332.39858	-11	6.60E-02	2.7	2.1	9
(Q)Q (6,A+, 6,a)	6 A- A2e 4 a 6 0	nu1	3333.02520	135	4.08E-01	2.7	19.1	8
(Q)Q (5,A+, 3,a)	5 A- A2o 6 a 3 0	nu1	3333.08666	-5	1.32E-01	4.3	-2.6	7
(P)P (8,E , 7,a)	7 E Ee 21 a 6-1	nu3	3333.43583	33	3.44E-02	4.4	3.8	7
(Q)Q (5,E , 5,a)	5 E Eo 10 a 5 0	nu1	3333.64481	40	2.45E-01	3.4	-4.1	8
(Q)Q (4,E , 2,a)	4 E Ee 11 a 2 0	nu1	3333.73832	0	5.55E-02	3.5	0.9	9
(Q)Q (6,A+, 3,a)	6 A- A2e 8 a 3 0	nu1	3333.97361	19	6.61E-02	4.4	2.5	9
(Q)Q (6,E , 4,a)	6 E Eo 15 a 4 0	nu1	3334.12338	6	6.60E-02	2.3	0.9	9
(Q)Q (4,E , 4,a)	4 E Ee 10 a 4 0	nu1	3334.16807	36	2.72E-01	2.5	-1.1	8
(Q)Q (7,E , 7,a)	7 E Ee 7 a 7 0	nu1	3334.25893	-87	1.60E-01	3.9	-1.9	8
(Q)Q (6,E , 5,a)	6 E Ee 11 a 5 0	nu1	3334.41445	-16	1.19E-01	3.9	-2.2	7
(Q)Q (3,A+, 3,a)	3 A- A2o 4 a 3 0	nu1	3334.59825	32	5.03E-01	3.5	-3.5	8
(Q)Q (5,E , 4,a)	5 E Eo 13 a 4 0	nu1	3335.05559	-8	1.40E-01	1.8	0.3	8
**(N)Q (7,A+, 6,a)	7 A- A2o 6 a 3 0	2nu4	3335.23713	-36	2.45E-02	4.2	15.0	7
(Q)Q (4,E , 2,a)	4 E Eo 11 a 2 0	nu1	3335.42570	10	5.74E-02	2.7	2.7	8
(Q)Q (5,E , 5,a)	5 E Ee 10 a 5 0	nu1	3335.47572	-43	2.58E-01	1.9	-0.4	5
(Q)Q (4,A+, 3,a)	4 A- A2e 5 a 3 0	nu1	3335.63576	-3	2.77E-01	4.2	0.3	8
(Q)Q (4,E , 4,a)	4 E Eo 10 a 4 0	nu1	3335.97602	-30	2.78E-01	3.2	-0.9	8
(Q)Q (3,E , 1,a)	3 E Ee 9 a 1 0	nu1	3336.00076	6	2.42E-02	3.7	-4.6	6
(P)P (7,E , 5,a)	6 E Ee 21 a 4-1	nu3	3336.09446	-9	3.73E-02	3.0	7.4	9
(Q)Q (3,E , 2,a)	3 E Eo 8 a 2 0	nu1	3336.13868	-3	1.11E-01	2.1	3.8	8
(Q)Q (3,A-, 3,a)	3 A+ A2e 5 a 3 0	nu1	3336.39046	-22	5.14E-01	3.1	-3.0	8
(Q)Q (2,E , 2,a)	2 E Eo 6 a 2 0	nu1	3336.71603	-17	2.09E-01	2.5	1.7	8
(P)P (5,A+, 0,a)	4 A+ A2o 10 a 1 1	nu3	3336.91055	-14	8.06E-02	2.1	6.4	9
(Q)Q (1,E , 1,a)	1 E Ee 4 a 1 0	nu1	3336.95196	-15	1.06E-01	1.4	-0.2	8
(P)R (7,E , 5,a)	8 E Eo 4 a 6-2	2nu4	3337.80908	27	3.67E-03	1.4	2.4	3
(P)P (6,A-, 3,a)	5 A- A2o 9 a 2-1	nu3	3339.45745	8	7.15E-02	2.3	6.4	9
(P)P (6,A+, 3,a)	5 A+ A2e 11 a 2-1	nu3	3339.85577	-30	7.14E-02	3.1	6.0	9
**(N)Q (8,A-, 6,a)	8 A+ A2o 7 a 3 0	2nu4	3342.07355	-223	2.45E-03	0.4	21.9	4
(Q)R (5,E , 4,a)	6 E Ee 5 a 4 0	2nu4	3342.97728	61	1.41E-02	4.2	8.3	3

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(R)P (4,E , 2,a)	3 E Eo 10 a 3 1	nu3	3343.42736	-43	4.67E-03	2.0	9.3	3
(P)P (5,E , 1,a)	4 E Eo 18 a 0 1	nu3	3344.34453	42	2.82E-02	2.8	5.4	6
(P)P (5,E , 1,a)	4 E Ee 18 a 0 1	nu3	3344.68373	-16	2.87E-02	3.4	6.5	8
(P)P (7,A+, 6,a)	6 A+ A2o 11 a 5-1	nu3	3345.62085	20	1.05E-01	2.1	12.0	8
(R)R (8,A+, 6,a)	9 A+ A2e 3 a 7-2	2nu4	3346.42276	-60	3.57E-03	4.7	-1.5	4
(R)R (6,A+, 3,a)	7 A+ A2e 3 a 4-2	2nu4	3346.80261	-180	4.70E-03	4.7	-40.5	4
(Q)R (5,A+, 3,a)	6 A+ A2o 4 a 3 0	2nu4	3347.35880	14	3.19E-02	3.4	6.6	9
(P)R (3,E , 2,a)	4 E Ee 9 a 1 2	2nu4	3347.62791	12	1.36E-03	1.6	7.8	3
(Q)R (5,E , 1,a)	6 E Ee 9 a 1 0	2nu4	3348.48222	182	9.53E-03	4.0	-3.9	4
**(S)R (4,A+, 0,a)	5 A+ A2e 6 a 2 2	2nu4	3349.34093	31	9.05E-03	4.2	2.3	4
(Q)R (5,A+, 0,a)	6 A+ A2o 6 a 0 0	2nu4	3349.61707	85	2.70E-02	4.6	8.9	7
(R)P (4,E , 1,a)	3 E Eo 12 a 2 1	nu3	3350.20223	17	1.20E-02	3.0	6.4	3
(R)P (4,E , 1,a)	3 E Ee 12 a 2 1	nu3	3350.55824	-35	1.31E-02	4.7	14.5	3
(P)P (5,E , 2,a)	4 E Ee 17 a 1-1	nu3	3352.43803	28	3.97E-02	3.3	7.5	9
**(*)R (5,E , 2,a)	6 E Ee 8 * * *	**	3353.49781	54	1.24E-02	1.7	12.3	3
**(S)R (6,A-, 3,a)	7 A- A2o 4 a 5 2	2nu4	3353.68501	85	5.79E-03	3.7	-10.4	4
(R)R (5,E , 1,a)	6 E Ee 10 a 2-2	2nu4	3354.10469	68	5.33E-03	3.4	12.6	4
(P)P (7,E , 7,a)	6 E Ee 17 a 6-1	nu3	3355.56523	85	7.52E-02	2.8	16.4	9
**(S)Q (8,E , 5,a)	8 E Ee 20 a 7-1	nu3	3356.13461	-81	2.77E-04	6.7	63.5	3
(R)R (7,E , 4,a)	8 E Ee 7 a 5-2	2nu4	3357.27418	36	1.90E-03	4.8	-7.1	4
(P)R (4,E , 1,a)	5 E Ee 11 a 0 2	2nu4	3357.34042	55	2.09E-03	4.6	-6.8	5
(P)P (6,E , 5,a)	5 E Eo 17 a 4-1	nu3	3357.40600	4	6.51E-02	2.3	10.3	9
(R)P (4,A+, 0,a)	3 A+ A2e 8 a 1 1	nu3	3357.64880	20	8.82E-02	3.2	7.3	9
(P)P (6,E , 5,a)	5 E Ee 17 a 4-1	nu3	3357.86217	8	6.64E-02	1.9	11.6	9
(Q)R (6,A+, 6,a)	7 A+ A2e 2 a 6 0	2nu4	3357.97013	108	1.18E-02	2.4	-0.1	4
(P)R (3,A+, 3,a)	4 A+ A2o 5 a 2 2	2nu4	3360.50411	143	6.69E-04	4.6	-2.8	3
(P)P (5,A+, 3,a)	4 A+ A2o 9 a 2-1	nu3	3360.90122	21	1.07E-01	1.8	7.6	8
(P)P (5,A-, 3,a)	4 A- A2e 7 a 2-1	nu3	3361.27498	-19	1.08E-01	2.3	8.3	8
**(*)R (6,E , 2,a)	7 E Ee 9 * * *	**	3362.15406	83	5.01E-03	3.7	-1.0	3
**(T)R (8,E , 5,a)	9 E Eo 6 a 8 0	nu1	3362.88056	104	5.70E-04	2.7	-0.8	3
**(Q)R (4,E , 1,a)	5 E Ee 12 a 1 2	2nu4	3363.05560	32	2.16E-03	2.8	-1.6	5
(Q)R (6,E , 5,a)	7 E Eo 5 a 5 0	2nu4	3363.49642	66	1.05E-02	1.1	7.6	3
(R)R (6,E , 2,a)	7 E Eo 9 a 3-2	2nu4	3363.89706	174	2.15E-03	0.8	70.0	4
(P)P (4,E , 1,a)	3 E Eo 14 a 0 1	nu3	3365.42825	19	3.59E-02	2.6	10.4	9
**(S)R (7,E , 4,a)	8 E Ee 9 a 6 2	2nu4	3365.52292	-27	1.16E-03	1.8	-10.6	3
(P)P (4,E , 1,a)	3 E Ee 14 a 0 1	nu3	3365.80877	-25	3.61E-02	2.9	10.5	9
(Q)R (6,E , 1,a)	7 E Eo 11 a 1 0	2nu4	3366.23838	26	1.05E-02	4.1	9.5	3
(R)R (6,E , 2,a)	7 E Ee 10 a 3-2	2nu4	3366.67040	-122	3.09E-03	0.8	-20.4	3
(Q)R (6,A+, 0,a)	7 A+ A2e 7 a 0 0	2nu4	3367.37695	46	2.53E-02	3.9	15.3	7
(Q)R (6,E , 4,a)	7 E Ee 8 a 4 0	2nu4	3368.39855	0	1.31E-02	2.2	10.9	3
(R)R (5,A+, 0,a)	6 A+ A2o 7 a 1-2	2nu4	3368.76682	-88	1.12E-02	2.8	9.6	3
**(S)R (5,E , 1,a)	6 E Ee 12 a 3 2	2nu4	3368.94806	33	5.45E-03	3.1	18.1	4
(P)P (5,E , 4,a)	4 E Ee 15 a 3-1	nu3	3369.71179	14	7.44E-02	2.2	10.3	8
(P)P (5,E , 4,a)	4 E Eo 15 a 3-1	nu3	3370.14890	-4	7.52E-02	2.7	11.0	9
(R)P (3,E , 1,a)	2 E Eo 8 a 2 1	nu3	3371.00968	3	7.20E-03	3.3	9.1	3
(R)P (3,E , 1,a)	2 E Ee 8 a 2 1	nu3	3371.38822	-49	7.25E-03	3.5	9.5	3
(P)P (4,E , 2,a)	3 E Ee 13 a 1-1	nu3	3373.56761	28	5.03E-02	2.5	6.3	9
(Q)R (6,A-, 3,a)	7 A- A2o 6 a 3 0	2nu4	3373.71753	-36	2.50E-02	3.0	12.9	7
(R)Q (9,E , 8,a)	9 E Ee 9 a 9 1	nu3	3373.76477	-36	2.74E-03	1.7	-17.2	3
(P)P (4,E , 2,a)	3 E Eo 13 a 1-1	nu3	3373.95364	-26	5.23E-02	2.5	9.7	8
(Q)R (1,E , 1,a)	2 E Eo 7 a 1 0	nu1	3374.55136	22	1.16E-01	2.7	0.8	8
(Q)R (1,A+, 0,a)	2 A+ A2o 4 a 0 0	nu1	3376.26976	-2	2.92E-01	2.7	-4.9	8
(Q)R (7,E , 7,a)	8 E Eo 3 a 7 0	2nu4	3377.40034	143	4.23E-03	1.7	2.3	3
(R)P (3,A+, 0,a)	2 A+ A2o 6 a 1 1	nu3	3378.05223	-41	7.79E-02	1.9	8.0	9
(P)P (5,E , 5,a)	4 E Eo 13 a 4-1	nu3	3378.91801	19	1.03E-01	2.0	12.4	8
(P)P (5,E , 5,a)	4 E Ee 13 a 4-1	nu3	3379.41088	23	1.06E-01	2.6	14.7	8
(R)R (6,E , 1,a)	7 E Ee 13 a 2-2	2nu4	3380.07089	117	2.81E-03	3.3	15.1	3
(R)Q (8,E , 7,a)	8 E Eo 12 a 8 1	nu3	3381.06881	-22	4.59E-03	1.5	-17.9	3
(R)Q (10,A-, 6,a)	10 A+ A2o 14 a 7 1	nu3	3381.90051	29	3.28E-03	2.2	-35.3	3
(R)Q (8,E , 7,a)	8 E Ee 12 a 8 1	nu3	3382.25621	6	5.45E-03	4.0	0.5	4
(Q)R (7,A-, 6,a)	8 A- A2e 3 a 6 0	2nu4	3383.74976	59	1.42E-02	2.9	5.6	4
**(*)R (7,E , 2,a)	8 E Ee 13 * * *	**	3384.40848	6	4.77E-03	1.0	10.8	3
(R)Q (9,A+, 6,a)	9 A- A2o 11 a 7 1	nu3	3384.97830	33	7.08E-03	1.7	-27.6	3
(P)P (3,E , 1,a)	2 E Eo 10 a 0 1	nu3	3386.26431	15	3.71E-02	2.5	9.6	9
(P)P (3,E , 1,a)	2 E Ee 10 a 0 1	nu3	3386.66003	-37	3.73E-02	4.0	9.9	9
(P)R (5,E , 1,a)	6 E Eo 14 a 0 2	2nu4	3386.83957	108	2.31E-03	1.6	29.2	3
(R)Q (8,A+, 6,a)	8 A- A2e 9 a 7 1	nu3	3387.44069	2	1.40E-02	4.1	-6.8	3
(Q)R (7,E , 1,a)	8 E Eo 15 a 1 0	2nu4	3387.99399	-114	7.54E-03	2.4	17.3	3
(Q)R (7,E , 5,a)	8 E Eo 8 a 5 0	2nu4	3389.28834	-58	8.97E-03	3.2	8.7	3
(R)Q (7,A-, 6,a)	7 A+ A2e 8 a 7 1	nu3	3389.97285	-12	1.58E-02	2.1	-7.8	3
(R)Q (9,E , 5,a)	9 E Eo 28 a 6 1	nu3	3390.29554	-136	4.89E-03	0.5	12.2	3
(R)Q (7,A+, 6,a)	7 A- A2o 8 a 7 1	nu3	3390.35650	-4	1.52E-02	2.8	-12.5	3
(P)P (4,E , 4,a)	3 E Ee 11 a 3-1	nu3	3390.91569	18	1.04E-01	2.5	11.6	8
(P)P (4,E , 4,a)	3 E Eo 11 a 3-1	nu3	3391.38357	-1	1.08E-01	4.9	14.5	8
(R)Q (8,E , 5,a)	8 E Ee 24 a 6 1	nu3	3393.62510	52	6.61E-03	4.6	-20.8	3
(Q)R (2,A+, 0,a)	3 A+ A2e 6 a 0 0	nu1	3393.80352	5	3.70E-01	2.1	-4.8	8
(Q)R (2,E , 1,a)	3 E Eo 9 a 1 0	nu1	3393.84862	9	1.74E-01	2.7	-1.1	8
(Q)R (2,E , 2,a)	3 E Ee 8 a 2 0	nu1	3393.98920	19	1.16E-01	2.6	0.3	8
(P)P (3,E , 2,a)	2 E Ee 9 a 1-1	nu3	3394.41488	15	6.27E-02	3.1	13.4	9
(Q)R (7,E , 4,a)	8 E Ee 11 a 4 0	2nu4	3394.57724	-167	9.84E-03	3.7	12.4	3
(P)P (3,E , 2,a)	2 E Eo 9 a 1-1	nu3	3394.83265	-31	6.09E-02	2.8	10.5	9
(Q)R (2,E , 1,a)	3 E Ee 9 a 1 0	nu1	3395.59878	6	1.77E-01	2.8	-0.9	8
(Q)R (2,E , 2,a)	3 E Eo 8 a 2 0	nu1	3395.76530	-2	1.18E-01	2.3	0.0	8
(R)Q (7,E , 5,a)	7 E Eo 20 a 6 1	nu3	3395.81522	14	1.11E-02	2.8	-8.9	3
(R)Q (9,E , 4,a)	9 E Eo 32 a 5 1	nu3	3396.77623	-2	2.99E-03	2.4	-37.3	3
(R)Q (6,E , 5,a)	6 E Ee 16 a 6 1	nu3	3398.46217	-15	1.21E-02	2.5	-4.4	3

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(R)R (6,A+, 0,a)	7 A+ A2e 9 a 1-2	2nu4	3399.11920	-146	5.34E-03	3.0	11.5	4
(R)Q (10,A-, 3,a)	10 A+ A2o 20 a 4 1	nu3	3399.78621	-16	2.15E-03	3.4	-45.9	3
(R)Q (10,A+, 3,s)	10 A- A2o 18 s 4 1	nu3	3400.00096	-29	2.56E-03	3.5	-22.6	3
(Q)R (7,A+, 3,a)	8 A+ A2o 7 s 3 0	2nu4	3400.62947	-224	2.17E-02	2.6	29.6	6
**(Q)R (5,A+, 3,a)	6 A+ A2o 7 a 3-2	2nu4	3401.18226	-88	2.62E-03	2.1	-4.1	3
(R)Q (7,E , 4,a)	7 E Ee 24 a 5 1	nu3	3401.91622	21	1.18E-02	2.8	-11.4	3
(R)Q (7,E , 4,s)	7 E Eo 24 s 5 1	nu3	3402.22472	-22	1.14E-02	3.8	-16.1	3
**(*)R (8,A-, 3,a)	9 A- A2o 7 * * *	**	3402.32518	93	3.66E-03	3.4	-1.1	4
(P)P (3,A+, 3,a)	2 A+ A2o 5 a 2-1	nu3	3402.93518	14	1.83E-01	3.9	10.6	8
(R)Q (9,A-, 3,s)	9 A+ A2e 18 s 4 1	nu3	3403.12694	-2	5.52E-03	3.1	-30.0	4
(P)P (3,A-, 3,s)	2 A- A2e 3 s 2-1	nu3	3403.38391	-21	1.86E-01	2.2	11.7	8
(Q)R (8,E , 7,a)	9 E Eo 5 s 7 0	2nu4	3403.73138	42	4.62E-03	2.5	5.9	3
(R)Q (6,E , 4,a)	6 E Ee 20 a 5 1	nu3	3404.21112	22	1.71E-02	2.9	-6.6	4
**(S)R (6,A+, 0,a)	7 A+ A2e 10 s 2 2	2nu4	3404.40219	-106	1.49E-02	3.9	5.6	5
(R)Q (8,A-, 3,a)	8 A+ A2o 16 a 4 1	nu3	3405.79656	94	1.14E-02	4.0	-28.0	4
(R)Q (8,A+, 3,s)	8 A- A2e 14 s 4 1	nu3	3406.02268	10	1.15E-02	0.5	-27.3	3
(R)Q (5,E , 4,a)	5 E Ee 16 a 5 1	nu3	3406.19151	1	1.73E-02	4.2	-0.9	5
(R)Q (5,E , 4,s)	5 E Eo 16 s 5 1	nu3	3406.57553	-25	1.73E-02	4.3	-1.3	4
(P)P (2,E , 1,a)	1 E Eo 6 a 0 1	nu3	3406.80284	8	3.23E-02	4.2	8.8	7
(P)P (2,E , 1,s)	1 E Ee 6 s 0 1	nu3	3407.21845	-44	3.46E-02	3.7	14.5	7
(R)Q (7,A+, 3,a)	7 A- A2o 12 a 4 1	nu3	3408.20800	-78	2.30E-02	4.7	-13.4	7
**(S)R (7,E , 2,a)	8 E Ee 16 s 4 2	2nu4	3408.40290	105	5.41E-03	3.2	12.7	5
(R)Q (7,A-, 3,s)	7 A+ A2e 14 s 4 1	nu3	3408.63849	9	2.32E-02	4.0	-12.7	7
**(O)R (5,E , 4,a)	6 E Ee 10 s 2-2	2nu4	3408.66467	68	8.71E-04	4.9	-0.2	3
(R)Q (9,E , 2,a)	9 E Ee 34 a 3 1	nu3	3409.56355	15	2.14E-03	2.1	-51.4	3
(R)Q (6,A-, 3,a)	6 A+ A2o 12 a 4 1	nu3	3410.62248	30	3.78E-02	2.9	-6.5	9
**(O)R (6,E , 1,a)	7 E Eo 17 s 1 2	2nu4	3410.82182	-83	3.05E-03	2.7	-23.3	4
(R)Q (6,A+, 3,s)	6 A- A2e 10 s 4 1	nu3	3410.96710	-2	3.82E-02	2.9	-5.8	9
(R)Q (8,E , 2,a)	8 E Ee 30 a 3 1	nu3	3412.45088	55	5.22E-03	1.3	-28.7	4
(R)Q (5,A+, 3,a)	5 A- A2o 8 a 4 1	nu3	3412.62920	24	5.07E-02	2.7	-0.6	9
(R)Q (8,E , 2,s)	8 E Eo 30 s 3 1	nu3	3412.70566	11	5.30E-03	3.7	-27.2	5
(Q)R (3,E , 1,a)	4 E Eo 12 s 1 0	nu1	3412.95923	-10	1.93E-01	2.7	0.4	8
(R)Q (5,A-, 3,s)	5 A+ A2e 10 s 4 1	nu3	3412.98991	-19	4.93E-02	3.5	-3.8	9
(Q)R (3,E , 2,a)	4 E Ee 11 s 2 0	nu1	3413.08757	0	1.65E-01	1.9	1.4	8
(Q)R (3,A+, 3,a)	4 A+ A2o 6 s 3 0	nu1	3413.32061	18	2.09E-01	2.6	-0.2	8
(R)Q (4,A-, 3,a)	4 A+ A2o 8 a 4 1	nu3	3414.31027	3	4.70E-02	2.8	4.2	9
(Q)R (3,A+, 0,s)	4 A+ A2o 7 a 0 0	nu1	3414.63633	20	3.88E-01	3.2	-5.6	8
(Q)R (3,E , 2,s)	4 E Eo 11 a 2 0	nu1	3414.83281	11	1.66E-01	1.7	0.1	8
(P)P (2,E , 2,a)	1 E Ee 5 a 1-1	nu3	3414.97186	9	6.48E-02	2.7	12.2	9
(Q)R (3,A-, 3,s)	4 A- A2e 5 a 3 0	nu1	3415.10567	-3	2.06E-01	3.2	-3.5	8
(R)Q (7,E , 2,s)	7 E Eo 26 s 3 1	nu3	3415.34275	14	1.06E-02	3.2	-17.7	3
(P)P (2,E , 2,s)	1 E Eo 5 s 1-1	nu3	3415.40982	-37	6.54E-02	4.9	12.6	9
(Q)R (9,A+, 9,a)	10 A+ A2o 2 s 9 0	2nu4	3415.49844	223	3.46E-03	1.8	4.2	4
(R)Q (9,E , 1,s)	9 E Ee 36 s 2 1	nu3	3416.77877	-20	2.09E-03	0.7	-40.7	3
(R)Q (6,E , 2,a)	6 E Ee 22 a 3 1	nu3	3417.25513	-54	1.81E-02	2.6	-12.0	7
(R)Q (6,E , 2,s)	6 E Eo 22 s 3 1	nu3	3417.68875	6	1.99E-02	4.4	-2.3	7
**(O)R (6,E , 1,s)	7 E Ee 19 s 1 2	2nu4	3418.34869	-2	6.23E-03	3.1	4.3	4
(R)Q (5,E , 2,a)	5 E Ee 18 a 3 1	nu3	3419.36707	32	2.81E-02	3.0	-1.3	8
(R)Q (8,E , 1,a)	8 E Eo 32 a 2 1	nu3	3419.44973	36	5.54E-03	2.6	-11.4	4
**(O)R (6,E , 2,a)	7 E Ee 17 s 0 2	2nu4	3419.48356	125	2.65E-03	3.7	-11.0	3
(R)Q (8,E , 1,s)	8 E Ee 32 s 2 1	nu3	3419.70371	-4	4.98E-03	4.1	-24.3	3
(R)Q (5,E , 2,s)	5 E Eo 18 s 3 1	nu3	3419.72741	-8	2.75E-02	1.9	-3.9	8
(P)Q (10,A+, 0,a)	10 A- A2e 20 a 1 1	nu3	3420.78642	2	2.89E-03	2.4	-58.0	3
(R)Q (4,E , 2,a)	4 E Ee 14 a 3 1	nu3	3421.06987	22	3.39E-02	2.7	2.4	9
(P)R (7,A+, 0,s)	8 A+ A2o 11 s 1-2	2nu4	3421.24147	-185	3.93E-03	3.4	28.6	4
(R)Q (4,E , 2,s)	4 E Eo 14 s 3 1	nu3	3421.44604	-26	3.38E-02	3.7	1.8	9
(P)Q (7,E , 1,a)	7 E Eo 28 a 2 1	nu3	3422.08400	60	1.00E-02	3.4	-16.2	4
(R)Q (7,E , 1,s)	7 E Ee 28 s 2 1	nu3	3422.36209	2	1.06E-02	3.9	-10.2	4
(R)Q (3,E , 2,a)	3 E Ee 10 a 3 1	nu3	3422.43833	4	2.95E-02	4.0	8.5	8
(P)Q (3,E , 2,s)	3 E Eo 10 s 3 1	nu3	3422.83448	-43	2.88E-02	2.1	5.9	8
(P)Q (9,A+, 0,s)	9 A- A2o 18 s 1 1	nu3	3424.15446	15	7.23E-03	3.5	-48.7	4
(P)Q (6,E , 1,a)	6 E Eo 24 a 2 1	nu3	3424.43459	76	1.77E-02	2.7	-10.3	7
(R)Q (6,E , 1,s)	6 E Ee 24 s 2 1	nu3	3424.73004	1	1.80E-02	3.8	-8.9	7
**(O)R (6,E , 2,s)	7 E Eo 18 a 0 2	2nu4	3425.95145	87	3.85E-03	4.5	-16.0	3
(R)Q (5,E , 1,a)	5 E Eo 20 a 2 1	nu3	3426.37327	-22	2.69E-02	2.4	-6.9	8
(P)P (1,E , 1,a)	0 E Eo 2 a 0 1	nu3	3427.02381	3	2.35E-02	2.9	11.6	6
(P)P (1,E , 1,s)	0 E Ee 2 s 0 1	nu3	3427.45486	-48	2.36E-02	2.4	11.7	6
(R)Q (4,E , 1,s)	4 E Ee 16 s 2 1	nu3	3428.52739	-19	3.77E-02	3.1	2.1	9
(R)Q (3,E , 1,a)	3 E Eo 12 a 2 1	nu3	3429.53565	18	4.10E-02	3.7	4.9	9
(R)Q (7,A+, 0,s)	7 A- A2o 14 s 1 1	nu3	3429.74538	9	3.69E-02	2.8	-17.1	9
(Q)R (9,E , 8,s)	10 E Eo 7 a 8 0	2nu4	3429.98107	177	2.51E-03	1.8	5.4	3
(R)Q (2,E , 1,a)	2 E Eo 8 a 2 1	nu3	3430.57900	3	3.17E-02	3.9	6.2	9
(R)Q (2,E , 1,s)	2 E Ee 8 s 2 1	nu3	3430.98607	-49	3.26E-02	2.9	8.5	9
(P)Q (9,E , 1,a)	9 E Eo 38 a 0 1	nu3	3431.56618	-3	1.64E-03	3.4	-50.7	3
(R)Q (6,A+, 0,a)	6 A- A2e 12 a 1 1	nu3	3431.79669	47	6.59E-02	2.7	-11.0	9
(Q)R (4,A+, 0,a)	5 A+ A2e 8 s 0 0	nu1	3431.88520	-41	3.41E-01	2.1	-3.6	8
(Q)R (4,E , 1,a)	5 E Eo 15 s 1 0	nu1	3431.91867	-37	1.71E-01	2.4	-1.0	8
(Q)R (4,E , 2,a)	5 E Ee 14 s 2 0	nu1	3432.02561	-24	1.62E-01	1.9	1.1	8
(Q)R (4,A-, 3,a)	5 A- A2o 6 s 3 0	nu1	3432.22513	-5	2.67E-01	2.8	-0.8	8
(Q)R (4,E , 4,a)	5 E Ee 13 s 4 0	nu1	3432.54753	18	8.67E-02	3.0	0.2	9
(Q)R (4,E , 1,s)	5 E Ee 15 a 1 0	nu1	3433.63093	28	1.75E-01	2.5	-0.8	8
(Q)R (4,E , 2,s)	5 E Eo 14 a 2 0	nu1	3433.75096	22	1.63E-01	2.5	0.1	8
(Q)R (4,A+, 3,s)	5 A+ A2e 7 a 3 0	nu1	3433.97824	11	2.70E-01	2.2	-1.3	8
(R)Q (5,A+, 0,s)	5 A- A2o 10 s 1 1	nu3	3434.20169	-6	1.07E-01	1.8	-3.5	8
(Q)R (4,E , 4,s)	5 E Eo 13 a 4 0	nu1	3434.35042	-7	8.91E-02	2.6	1.2	9
**(O)R (6,E , 4,a)	7 E Eo 13 s 2-2	2nu4	3434.40990	116	2.19E-03	1.7	9.8	4

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(P)Q (8,E , 1,a)	8 E Eo 34 a 0 1	nu3	3434.48712	11	3.94E-03	4.3	-32.5	4
(P)Q (8,E , 1,s)	8 E Ee 34 s 0 1	nu3	3434.77511	0	4.01E-03	3.8	-30.5	4
(R)R (9,A-, 3,s)	10 A- A2e 10 s 4-2	2nu4	3435.32944	66	6.78E-04	3.4	42.3	3
(R)Q (4,A+, 0,a)	4 A- A2e 8 a 1 1	nu3	3435.57739	36	1.45E-01	2.1	-0.7	8
(P)Q (7,E , 1,a)	7 E Eo 30 a 0 1	nu3	3437.15434	28	8.09E-03	2.8	-22.6	4
(R)Q (3,A+, 0,s)	3 A- A2o 6 s 1 1	nu3	3437.36890	-31	1.74E-01	1.7	3.9	8
(P)Q (7,E , 1,s)	7 E Ee 30 s 0 1	nu3	3437.46903	0	8.46E-03	4.3	-17.5	5
(R)Q (2,A+, 0,a)	2 A- A2e 4 a 1 1	nu3	3438.02814	12	1.69E-01	1.7	5.6	8
**(Q)R (7,E , 1,a)	8 E Eo 22 s 1 2	2nu4	3438.24127	-142	4.07E-03	1.3	-16.7	4
(R)Q (1,A+, 0,s)	1 A- A2o 2 s 1 1	nu3	3439.15589	-52	1.29E-01	2.2	9.5	8
(P)Q (6,E , 1,a)	6 E Eo 26 a 0 1	nu3	3439.53624	39	1.62E-02	4.1	-3.6	5
(P)Q (9,E , 2,a)	9 E Ee 37 a 1-1	nu3	3439.61212	-14	1.52E-03	2.7	-50.8	3
**(O)R (6,E , 5,a)	7 E Eo 9 s 3-2	2nu4	3440.41833	174	1.21E-03	3.1	7.4	3
(P)Q (5,E , 1,a)	5 E Eo 22 a 0 1	nu3	3441.61056	43	2.46E-02	3.0	-3.1	7
(P)Q (5,E , 1,s)	5 E Ee 22 s 0 1	nu3	3441.97416	-7	2.53E-02	2.8	-0.7	7
(P)Q (8,E , 2,a)	8 E Ee 33 a 1-1	nu3	3442.54399	-6	4.02E-03	4.8	-19.6	4
(P)Q (8,E , 2,s)	8 E Eo 33 s 1-1	nu3	3442.85347	-10	3.76E-03	2.7	-28.4	4
**(S)R (7,A+, 0,a)	8 A+ A2o 12 a 2 2	2nu4	3443.29017	-32	2.03E-02	3.8	7.0	7
(P)Q (4,E , 1,a)	4 E Eo 18 a 0 1	nu3	3443.36332	42	3.41E-02	3.0	1.4	9
(P)Q (4,E , 1,s)	4 E Ee 18 s 0 1	nu3	3443.74575	-15	3.46E-02	2.6	2.5	9
(P)Q (10,A+, 3,a)	10 A- A2e 19 s 2-1	nu3	3444.67318	-142	1.09E-03	4.4	-70.1	3
(P)Q (3,E , 1,a)	3 E Eo 14 a 0 1	nu3	3444.76132	19	4.04E-02	3.3	4.8	9
(P)Q (3,E , 1,s)	3 E Ee 14 s 0 1	nu3	3445.17866	-25	4.06E-02	4.8	4.8	9
(P)Q (7,E , 2,a)	7 E Ee 29 a 1-1	nu3	3445.22998	9	7.80E-03	2.9	-16.3	4
(P)Q (7,E , 2,s)	7 E Eo 29 s 1-1	nu3	3445.56896	-9	7.80E-03	4.2	-16.6	5
(P)Q (2,E , 1,a)	2 E Eo 10 a 0 1	nu3	3445.83340	15	4.03E-02	2.4	-8.9	9
**(O)R (7,E , 2,a)	8 E Ee 22 s 0 2	2nu4	3446.33659	169	3.78E-03	1.4	-3.6	4
(P)Q (1,E , 1,a)	1 E Eo 6 a 0 1	nu3	3446.54863	8	2.94E-02	4.3	9.1	8
(P)Q (1,E , 1,s)	1 E Ee 6 s 0 1	nu3	3446.98444	-44	3.08E-02	2.8	13.0	7
**(Q)R (7,E , 1,s)	8 E Ee 23 a 1 2	2nu4	3447.16290	-100	8.11E-03	3.1	6.2	4
(P)Q (9,A+, 3,a)	9 A- A2o 17 a 2-1	nu3	3447.71412	-141	2.91E-03	2.6	-46.6	4
(P)Q (6,E , 2,a)	6 E Eo 25 a 1-1	nu3	3447.99870	-9	1.41E-02	3.5	-8.5	6
(P)Q (9,A-, 3,s)	9 A+ A2e 19 s 2-1	nu3	3448.62605	118	3.09E-03	3.4	-37.4	4
**(O)R (6,A-, 6,a)	7 A- A2o 3 a 4-2	2nu4	3449.23329	-46	1.66E-03	3.6	2.4	3
(P)Q (5,E , 2,a)	5 E Ee 21 a 1-1	nu3	3449.73105	28	2.30E-02	4.4	2.1	6
(P)Q (5,E , 2,s)	5 E Eo 21 s 1-1	nu3	3450.12090	-10	2.27E-02	2.4	0.8	7
(Q)R (5,E , 1,a)	6 E Eo 19 a 1 0	nu1	3450.79835	-65	1.35E-01	1.8	0.8	8
(Q)R (5,E , 2,a)	6 E Ee 18 s 2 0	nu1	3450.87293	-54	1.30E-01	2.4	0.5	8
(Q)R (5,A+, 3,a)	6 A+ A2o 9 s 3 0	nu1	3451.02088	-35	2.40E-01	2.0	-0.1	8
(P)Q (8,A+, 3,a)	8 A- A2e 15 s 2-1	nu3	3451.12824	-80	7.09E-03	1.6	-25.5	4
(Q)R (5,E , 4,a)	6 E Ee 15 s 4 0	nu1	3451.27478	-11	1.03E-01	2.5	1.4	8
(P)Q (4,E , 2,a)	4 E Ee 17 a 1-1	nu3	3451.50163	27	2.97E-02	2.9	3.4	8
(Q)R (5,E , 5,a)	6 E Eo 12 s 5 0	nu1	3451.68016	14	6.77E-02	2.5	1.5	9
(P)Q (4,E , 2,s)	4 E Eo 17 s 1-1	nu3	3451.92448	-5	3.06E-02	2.1	5.9	9
(Q)R (5,A+, 0,a)	6 A+ A2o 10 a 0 0	nu1	3452.52248	36	2.70E-01	2.0	-1.1	8
(Q)R (5,E , 1,s)	6 E Ee 19 a 1 0	nu1	3452.54451	36	1.32E-01	2.4	-2.4	8
(Q)R (5,E , 2,s)	6 E Eo 18 a 2 0	nu1	3452.61989	28	1.31E-01	1.9	0.0	8
(Q)R (5,A-, 3,s)	6 A- A2e 8 a 3 0	nu1	3452.77554	19	2.41E-01	2.4	-1.3	8
(P)Q (3,E , 2,a)	3 E Ee 13 a 1-1	nu3	3452.93677	27	3.31E-02	4.0	7.9	9
(Q)R (5,E , 4,s)	6 E Eo 15 a 4 0	nu1	3453.05515	6	1.03E-01	2.6	-0.2	8
(P)Q (3,E , 2,s)	3 E Eo 13 s 1-1	nu3	3453.36045	-26	3.40E-02	4.4	10.1	9
**(O)R (7,A+, 3,a)	8 A+ A2o 11 s 1-2	2nu4	3453.41145	-105	7.70E-03	3.4	3.7	4
(Q)R (5,E , 5,s)	6 E Ee 11 a 5 0	nu1	3453.51442	-16	6.73E-02	2.8	-0.7	9
(P)Q (7,A+, 3,a)	7 A- A2o 13 a 2-1	nu3	3453.57864	-40	1.56E-02	4.5	-5.6	7
**(O)R (7,E , 2,s)	8 E Eo 23 a 0 2	2nu4	3453.90078	48	6.09E-03	1.1	-6.6	4
(P)Q (2,E , 2,a)	2 E Ee 9 a 1-1	nu3	3454.01108	14	2.62E-02	4.2	11.2	8
(P)Q (7,A-, 3,s)	7 A+ A2e 15 s 2-1	nu3	3454.15240	17	1.44E-02	3.4	-14.1	5
(P)Q (2,E , 2,s)	2 E Eo 9 s 1-1	nu3	3454.45891	-31	2.64E-02	2.9	11.7	7
(P)Q (6,A-, 3,a)	6 A+ A2o 13 a 2-1	nu3	3456.16585	20	2.55E-02	3.0	-5.0	7
(P)Q (6,A+, 3,s)	6 A- A2e 11 s 2-1	nu3	3456.44920	-34	2.58E-02	3.5	-4.3	7
(P)Q (9,E , 4,s)	9 E Eo 35 s 3-1	nu3	3457.14327	2	1.39E-03	4.8	-43.2	3
(P)Q (5,A+, 3,a)	5 A- A2o 9 a 2-1	nu3	3458.20827	8	3.81E-02	2.6	1.0	9
(R)R (0,A+, 0,a)	1 A+ A2e 4 a 1 1	nu3	3458.61504	4	8.10E-02	2.6	10.9	9
(P)Q (5,A-, 3,s)	5 A+ A2e 11 s 2-1	nu3	3458.65748	-30	3.72E-02	4.3	-1.6	9
(P)Q (8,E , 4,a)	8 E Eo 31 a 3-1	nu3	3459.77151	-46	3.44E-03	3.0	-17.6	4
(P)Q (8,E , 4,s)	8 E Ee 31 s 3-1	nu3	3460.15007	-23	3.43E-03	3.0	-18.2	4
(P)Q (4,A+, 3,a)	4 A- A2e 7 s 2-1	nu3	3460.46062	-19	5.00E-02	2.7	12.3	9
**(O)R (7,E , 4,a)	8 E Ee 18 s 2-2	2nu4	3460.56116	169	3.66E-03	2.6	1.9	4
(P)Q (3,A+, 3,a)	3 A- A2o 5 a 2-1	nu3	3461.47626	17	3.97E-02	3.1	10.0	9
(P)Q (7,E , 4,a)	7 E Ee 27 a 3-1	nu3	3462.51434	-30	6.89E-03	3.4	-5.3	4
(P)Q (7,E , 4,s)	7 E Eo 27 s 3-1	nu3	3462.92576	-20	6.41E-03	3.9	-13.5	4
(P)Q (6,E , 4,a)	6 E Ee 23 a 3-1	nu3	3464.97854	-10	1.17E-02	2.3	3.9	3
(P)Q (9,E , 5,a)	9 E Ee 33 a 4-1	nu3	3466.35551	0	1.34E-03	3.9	-37.2	3
(P)Q (5,E , 4,a)	5 E Ee 19 a 3-1	nu3	3467.59404	-11	1.51E-02	5.0	5.3	5
(P)Q (4,E , 4,a)	4 E Eo 15 a 3-1	nu3	3469.44373	-4	1.47E-02	2.1	14.3	3
(Q)R (6,E , 2,a)	7 E Eo 22 s 2 0	nu1	3469.76642	-75	8.72E-02	3.3	-1.7	9
(Q)R (6,E , 4,a)	7 E Ee 18 s 4 0	nu1	3469.99664	-43	8.31E-02	2.5	1.5	9
(Q)R (6,E , 5,a)	7 E Eo 13 s 5 0	nu1	3470.29352	-48	7.04E-02	2.0	-0.4	9
(R)R (1,E , 1,a)	2 E Eo 8 a 2 1	nu3	3470.32544	4	5.90E-02	4.8	19.2	7
**(O)R (7,E , 5,a)	8 E Ee 14 a 3-2	2nu4	3470.99734	-180	5.03E-03	2.7	-8.7	3
(P)Q (7,E , 5,a)	7 E Eo 25 a 4-1	nu3	3471.74070	-54	5.54E-03	1.6	-10.8	4
(Q)R (6,E , 4,s)	7 E Eo 19 a 4 0	nu1	3471.84644	10	8.24E-02	2.4	-0.3	9
(Q)R (6,E , 5,s)	7 E Ee 14 a 5 0	nu1	3472.14330	-1	7.18E-02	2.6	-0.1	8
(P)Q (7,E , 5,s)	7 E Ee 25 s 4-1	nu3	3472.20264	-26	5.81E-03	4.6	-6.1	5
(Q)R (6,A-, 6,a)	7 A- A2o 5 a 6 0	nu1	3472.45705	-69	8.62E-02	2.7	-3.0	9
(P)Q (10,A-, 6,s)	10 A+ A2o 19 s 5-1	nu3	3472.57285	-79	3.43E-03	3.7	55.3	4

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
**(O)R (8,E , 2,a)	9 E Eo 26 a 0 2	2nu4	3473.17846	171	4.40E-03	3.2	-2.9	4
**(N)R (6,A-, 6,s)	7 A- A2o 6 s 3 0	2nu4	3474.12055	-36	9.45E-03	2.0	11.3	3
(P)Q (6,E , 5,a)	6 E Eo 21 a 4-1	nu3	3474.24885	-23	9.92E-03	2.9	14.1	4
(P)Q (6,E , 5,s)	6 E Ee 21 s 4-1	nu3	3474.73858	-9	9.47E-03	3.2	9.6	3
**(O)R (7,A+, 6,s)	8 A+ A2o 4 a 4-2	2nu4	3475.15591	4	6.90E-03	4.1	0.9	4
**(O)R (8,E , 1,s)	9 E Ee 27 s 1 2	2nu4	3475.51405	-241	8.67E-03	3.0	1.6	4
(P)Q (9,A-, 6,a)	9 A+ A2e 17 a 5-1	nu3	3475.59217	-13	2.54E-03	1.9	-30.7	4
(P)Q (9,A+, 6,s)	9 A- A2o 15 s 5-1	nu3	3475.96896	-5	2.71E-03	2.6	-23.3	4
(P)Q (5,E , 5,a)	5 E Eo 17 a 4-1	nu3	3476.44558	4	8.90E-03	3.8	7.9	4
(P)Q (5,E , 5,s)	5 E Ee 17 s 4-1	nu3	3476.96135	7	7.49E-03	4.9	-9.9	4
(P)R (7,A+, 6,s)	8 A+ A2o 5 s 5 2	2nu4	3477.44017	38	1.02E-03	2.2	-65.3	3
(R)R (1,A+, 0,s)	2 A+ A2o 6 s 1 1	nu3	3478.20012	-41	9.43E-02	2.4	10.9	9
(P)Q (8,A+, 6,a)	8 A- A2e 13 a 5-1	nu3	3478.59739	-55	5.35E-03	2.1	-16.0	4
(P)Q (8,A-, 6,s)	8 A+ A2o 15 s 5-1	nu3	3479.05131	-26	5.61E-03	3.9	-11.1	4
**(O)R (7,E , 7,s)	8 E Ee 7 a 5-2	2nu4	3479.70240	137	2.15E-03	3.9	-5.4	4
**(O)R (8,A-, 3,a)	9 A- A2o 12 s 1-2	2nu4	3480.01934	142	9.93E-03	2.2	2.6	3
**(O)R (8,E , 2,s)	9 E Eo 27 a 0 2	2nu4	3481.36678	26	7.99E-03	3.2	-1.7	4
(P)Q (7,A-, 6,a)	7 A+ A2e 13 a 5-1	nu3	3481.40704	-43	8.94E-03	3.1	-5.6	4
(P)Q (7,A+, 6,s)	7 A- A2o 11 s 5-1	nu3	3481.91587	-9	9.47E-03	2.6	-0.1	3
(R)R (2,E , 2,a)	3 E Ee 10 a 3 1	nu3	3482.03503	4	7.14E-02	3.1	8.8	9
(R)R (2,E , 2,s)	3 E Eo 10 s 3 1	nu3	3482.46084	-43	7.65E-02	2.5	14.6	8
(P)Q (6,A+, 6,a)	6 A- A2e 9 a 5-1	nu3	3483.95031	-14	1.07E-02	3.1	7.6	3
(P)Q (6,A-, 6,s)	6 A+ A2o 11 s 5-1	nu3	3484.50474	20	1.09E-02	3.3	8.6	3
(P)Q (9,E , 7,a)	9 E Eo 29 a 6-1	nu3	3485.52390	-75	1.32E-03	4.0	-9.4	3
(P)R (1,E , 1,a)	2 E Eo 10 a 0 1	nu3	3485.57932	15	6.82E-03	3.7	7.7	4
(P)R (7,E , 5,s)	8 E Ee 16 s 4 2	2nu4	3485.81165	106	3.12E-03	2.8	61.9	4
(P)Q (8,E , 7,a)	8 E Eo 25 a 6-1	nu3	3488.59901	-82	2.36E-03	3.5	-2.4	4
(Q)R (7,E , 4,a)	8 E Ee 21 s 4 0	nu1	3489.01384	-89	5.37E-02	5.0	2.9	8
(Q)R (7,E , 5,a)	8 E Eo 16 s 5 0	nu1	3489.05160	96	4.94E-02	3.2	3.4	9
(R)R (2,E , 1,a)	3 E Eo 12 a 2 1	nu3	3489.10479	18	3.97E-02	3.9	7.9	9
(P)Q (8,E , 7,s)	8 E Ee 25 s 6-1	nu3	3489.15170	-3	5.33E-03	4.0	54.5	4
(Q)R (7,A-, 6,a)	8 A- A2e 6 s 6 0	nu1	3489.28620	-74	8.40E-02	2.8	-6.3	9
(Q)R (7,E , 4,s)	8 E Eo 21 a 4 0	nu1	3491.23100	17	5.03E-02	4.4	-0.6	8
(Q)R (7,E , 2,s)	8 E Eo 26 s 2 0	nu1	3491.29952	33	5.73E-02	4.0	11.5	9
(Q)R (7,E , 1,s)	8 E Ee 27 s 1 0	nu1	3491.35375	62	4.99E-02	4.9	-0.9	8
(Q)R (7,A+, 0,s)	8 A+ A2o 14 a 0 0	nu1	3491.37379	60	9.76E-02	2.8	-2.8	9
(O)R (7,E , 7,s)	8 E Eo 10 a 7 0	nu1	3491.95032	-73	3.01E-02	2.1	-2.1	7
**(O)R (8,E , 5,a)	9 E Eo 18 s 3-2	2nu4	3492.01923	-39	6.59E-03	2.7	1.2	4
(P)Q (7,E , 7,s)	7 E Ee 21 s 6-1	nu3	3492.08110	33	3.04E-03	3.2	8.3	4
(R)R (3,A+, 3,a)	4 A+ A2o 8 a 4 1	nu3	3493.74047	3	1.53E-01	2.2	8.2	8
**(O)R (8,E , 5,s)	9 E Ee 18 a 3-2	2nu4	3496.37606	-48	1.05E-02	3.1	-10.0	4
(R)R (2,A+, 0,a)	3 A+ A2e 8 a 1 1	nu3	3496.52964	20	8.42E-02	2.2	9.6	9
**(*)R (8,A-, 6,a)	9 A- A2o 6 * * *	**	3498.54830	-5	9.16E-03	3.2	0.4	4
(P)Q (8,E , 8,a)	8 E Ee 20 s 7-1	nu3	3499.05194	-80	1.53E-03	3.9	5.6	3
**(O)R (9,E , 2,a)	10 E Ee 30 s 0 2	2nu4	3499.09896	160	4.71E-03	1.9	7.2	3
(R)R (3,E , 2,a)	4 E Ee 14 a 3 1	nu3	3500.43929	22	4.64E-02	3.9	8.1	7
**(O)R (8,E , 7,a)	9 E Eo 10 s 5-2	2nu4	3500.74893	-153	9.62E-03	2.9	-4.5	3
(R)R (3,E , 2,s)	4 E Eo 14 s 3 1	nu3	3500.85312	-26	4.75E-02	3.7	9.9	9
**(*)R (8,A-, 6,s)	9 A- A2o 7 * * *	**	3501.38215	93	1.65E-02	2.2	-7.2	5
(P)R (2,E , 1,a)	3 E Eo 14 a 0 1	nu3	3504.33029	19	9.33E-03	3.1	9.0	3
**(O)R (8,E , 8,s)	9 E Ee 6 s 6-2	2nu4	3504.68696	-32	9.41E-03	2.1	-2.4	3
(P)R (2,E , 1,s)	3 E Ee 14 s 0 1	nu3	3504.77628	-25	9.75E-03	3.4	12.6	3
(R)R (4,E , 4,a)	5 E Ee 16 s 5 1	nu3	3505.43705	1	7.16E-02	2.7	8.9	7
**(O)R (9,E , 2,s)	10 E Eo 31 a 0 2	2nu4	3506.75740	177	7.01E-03	1.8	-7.0	3
(O)R (8,E , 8,s)	9 E Eo 6 a 8 0	nu1	3507.30965	104	1.22E-02	2.7	-2.4	4
(R)R (3,E , 1,a)	4 E Eo 16 a 2 1	nu3	3507.48276	29	2.71E-02	4.0	6.4	5
(R)R (3,E , 1,s)	4 E Ee 16 s 2 1	nu3	3507.89704	-19	2.78E-02	4.3	8.6	7
(O)R (8,A-, 3,a)	9 A- A2o 14 s 3 0	nu1	3509.01054	-2	4.98E-02	2.8	-5.0	5
(O)R (8,E , 5,a)	9 E Eo 20 s 5 0	nu1	3509.06408	87	2.47E-02	5.0	-2.2	7
(O)R (8,A+, 6,a)	9 A+ A2e 8 s 6 0	nu1	3509.26939	52	4.53E-02	2.0	-2.2	7
**(O)R (9,E , 4,s)	10 E Ee 26 s 2-2	2nu4	3510.46496	79	6.61E-03	2.6	2.2	3
**(*)R (8,E , 8,a)	9 E Ee 7 * * *	**	3510.54087	29	1.12E-02	2.0	0.2	3
(R)R (4,A+, 3,a)	5 A+ A2e 10 s 4 1	nu3	3512.17543	-19	8.98E-02	1.4	9.3	5
(O)R (8,E , 2,s)	9 E Eo 30 a 2 0	nu1	3512.58153	15	2.28E-02	3.7	0.0	6
**(O)R (8,E , 8,s)	9 E Eo 7 a 6-2	2nu4	3513.39492	-95	7.63E-03	3.7	-12.8	3
(O)R (9,E , 4,s)	10 E Eo 25 a 4 0	nu1	3514.59116	-181	8.97E-03	2.3	-9.4	3
**(O)R (9,E , 5,a)	10 E Eo 22 s 3-2	2nu4	3515.05883	-70	8.50E-03	2.9	1.2	3
(R)R (3,A+, 0,s)	4 A+ A2o 10 s 1 1	nu3	3515.31469	-14	6.46E-02	2.4	10.2	7
(R)R (5,E , 5,s)	6 E Ee 16 s 6 1	nu3	3517.56231	-15	6.44E-02	2.5	15.7	5
(O)R (9,E , 5,s)	10 E Ee 22 a 5 0	nu1	3518.29562	201	1.11E-02	2.3	-4.9	3
(R)R (4,E , 2,a)	5 E Ee 18 a 3 1	nu3	3518.43083	32	2.68E-02	2.6	5.9	7
(R)R (4,E , 2,s)	5 E Eo 18 s 3 1	nu3	3518.83562	-8	2.74E-02	0.9	7.8	4
**(*)R (9,A+, 6,s)	10 A+ A2o 8 * * *	**	3519.48894	-123	1.61E-02	4.4	-10.9	6
**(*)R (9,E , 7,s)	10 E Ee 14 * * *	**	3521.91085	8	9.77E-03	3.8	-5.5	3
(P)R (3,E , 1,a)	4 E Eo 18 a 0 1	nu3	3522.69627	42	9.05E-03	1.1	15.9	3
**(*)R (9,A+, 6,s)	10 A+ A2o 9 * * *	**	3522.79840	-59	1.10E-02	4.7	20.1	4
(R)R (5,E , 4,s)	6 E Eo 20 s 5 1	nu3	3523.42275	-82	3.42E-02	3.0	1.3	6
(O)R (9,E , 8,a)	10 E Ee 10 s 8 0	nu1	3523.80746	23	1.40E-02	3.7	-5.6	4
(R)R (4,E , 1,a)	5 E Eo 20 a 2 1	nu3	3525.39199	-22	1.35E-02	3.8	-14.8	4
(R)R (4,E , 1,s)	5 E Ee 20 s 2 1	nu3	3525.85142	-7	1.68E-02	3.8	7.4	5
(O)R (9,A-, 9,s)	10 A- A2e 3 s 9 0	nu1	3527.67779	-33	2.25E-02	2.0	-7.3	3
(R)R (6,A+, 6,a)	7 A+ A2e 8 a 7 1	nu3	3528.78617	-11	9.05E-02	3.2	9.9	8
(R)R (6,A-, 6,s)	7 A- A2o 8 s 7 1	nu3	3529.23971	-5	1.00E-01	4.7	18.6	7
(R)R (5,A+, 3,a)	6 A+ A2o 12 a 4 1	nu3	3529.37334	30	4.41E-02	3.8	4.2	9
(R)R (5,A-, 3,s)	6 A- A2e 10 s 4 1	nu3	3529.76896	-2	4.53E-02	2.9	6.5	9
(O)R (9,E , 7,a)	10 E Ee 34 s 2 0	nu1	3530.39376	-159	8.41E-03	3.1	-20.4	3

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(P)R (3,E , 2,a)	4 E Ee 17 a 1-1	nu3	3530.86858	25	6.35E-03	0.3	46.1	3
**(*)R (9,A+, 3,a)	10 A+ A2o 17 * * *	**	3531.95409	227	6.51E-03	2.4	7.6	3
**(O)R (9,A-, 6,a)	10 A- A2e 10 s 4-2	2nu4	3532.50522	65	5.82E-03	2.6	-34.4	3
(R)R (4,A+, 0,a)	5 A+ A2e 22 a 1 1	nu3	3532.88271	76	4.12E-02	2.1	9.4	9
(R)R (6,E , 5,a)	7 E Eo 20 a 6 1	nu3	3534.39546	15	2.74E-02	4.7	8.8	7
(R)R (6,E , 5,s)	7 E Ee 20 s 6 1	nu3	3534.83109	22	2.83E-02	2.6	11.2	7
(R)R (5,E , 2,a)	6 E Ee 22 a 3 1	nu3	3535.91608	-54	3.14E-02	1.9	-16.4	3
(R)R (5,E , 2,s)	6 E Eo 22 s 3 1	nu3	3536.39963	6	1.46E-02	1.4	8.6	3
**(*)R (9,E , 1,s)	10 E Ee 36 * * *	**	3536.91378	-101	6.90E-03	2.1	-8.7	3
**(*)R (9,A+, 0,s)	10 A+ A2o 18 * * *	**	3536.94843	-58	1.41E-02	3.3	-6.8	5
**(*)R (9,E , 2,s)	10 E Eo 34 * * *	**	3537.04308	-168	6.81E-03	1.6	-5.9	3
**(*)R (9,E , 4,s)	10 E Eo 29 * * *	**	3538.01749	117	5.42E-03	1.4	-11.3	3
(R)R (6,E , 4,a)	7 E Ee 24 a 5 1	nu3	3540.30802	21	1.62E-02	2.6	3.8	6
(P)R (4,E , 1,a)	5 E Eo 22 a 0 1	nu3	3540.62948	43	5.60E-03	1.5	4.4	3
(R)R (6,E , 4,s)	7 E Eo 24 s 5 1	nu3	3540.67560	-22	1.84E-02	3.2	15.0	5
(R)R (7,E , 7,s)	8 E Ee 12 s 8 1	nu3	3540.90057	6	3.41E-02	3.2	17.2	8
(P)R (4,E , 1,s)	5 E Ee 22 s 0 1	nu3	3541.03514	-8	7.79E-03	2.2	31.1	3
(R)R (5,E , 1,a)	6 E Eo 24 a 2 1	nu3	3543.04240	77	8.87E-03	1.5	6.0	3
(R)R (5,E , 1,s)	6 E Ee 24 s 2 1	nu3	3543.38602	1	8.72E-03	2.2	4.1	3
(R)R (7,A-, 6,a)	8 A- A2e 9 a 7 1	nu3	3545.68882	2	3.78E-02	2.7	10.4	7
(R)R (7,A+, 6,s)	8 A+ A2o 10 s 7 1	nu3	3546.12634	22	3.91E-02	2.5	13.0	8
(R)R (6,A-, 3,a)	7 A- A2o 12 a 4 1	nu3	3546.45325	-78	1.61E-02	4.0	-21.5	4
(R)R (5,A+, 0,s)	6 A+ A2o 14 s 1 1	nu3	3550.76267	1	2.20E-02	3.6	6.4	6
(R)R (8,E , 8,a)	9 E Eo 9 a 9 1	nu3	3552.54161	18	2.12E-02	3.2	15.2	3
(R)R (8,E , 7,s)	9 E Ee 16 s 8 1	nu3	3557.41603	28	1.24E-02	3.5	14.8	3
(R)R (8,A+, 6,a)	9 A+ A2e 12 a 7 1	nu3	3562.15097	-19	1.36E-02	4.0	7.8	3
(R)R (8,A-, 6,s)	9 A- A2o 11 s 7 1	nu3	3562.58395	33	1.43E-02	2.4	11.9	3
(R)R (9,A+, 9,a)	10 A+ A2o 6 a10 1	nu3	3563.65201	-46	2.70E-02	4.0	21.6	3
(R)R (9,A-, 9,s)	10 A- A2e 6 s10 1	nu3	3564.16707	37	2.83E-02	4.3	25.0	6

Note :(I) :Assignment; (II) Identification of the upper level; (III): Vibrational band; (IV) : Observed wavenumber in cm^{-1}; (V) (Obs-calc) wavenumber in 10^{-3} cm^{-1}; (VI) S_0 in cm^{-2} atm^{-1} at 296 K; (VII) Experimental uncertainty in %; (VIII): S_0-S_o/S_0 in %; (IX) : number of *spectra* used for the measurements.

Figures Captions.

Figure 1. Vibration-inversion States of NH_3 in the 3-µm region (from Ref. [5]).

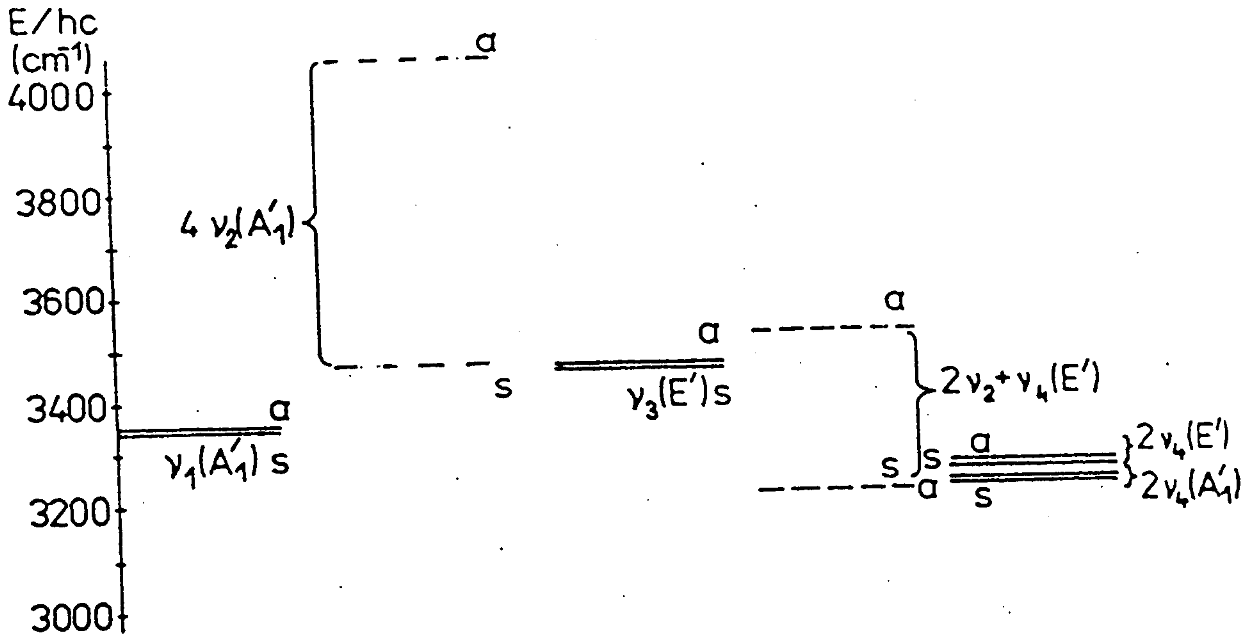
Fig. 2. Allowed (solid lines) and perturbation-allowed transitions (dashed lines) in ν_1 and ν_3 induced by Coriolis resonaces between ν_1 and ν_3 (C_{21}^{13s} term) and by K-type resonances in ν_1 or ν_3 (q_{3v} term) .

Fig. 3. Allowed (solid lines) and perturbation-allowed transitions due to the 2-2 "l-type" (q_2 term) resonances in $2\nu_4$ (dashed lines).

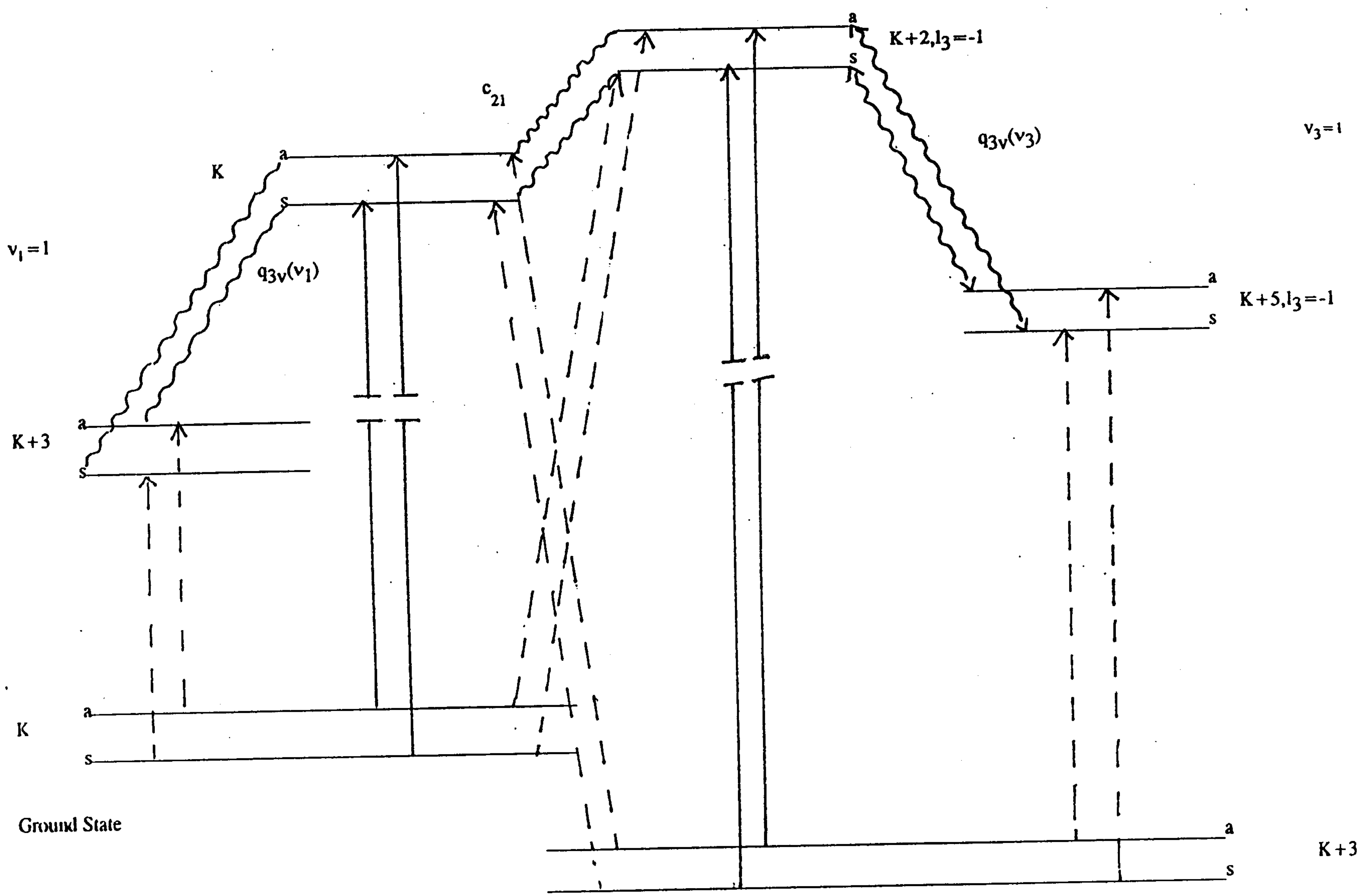
Fig. 4. Comparison of the observed and computed spectra using Kitt Peak data recorded at 0.012 cm^{-1} resolution with a 1.5 m cell and a gas sample of $^{14}NH_3$ of 2.6 Torr at 295 K. The plot above the spectrum shows the differences between the observed and calculated spectral digits x 100. Between 3450 and 3454 cm^{-1}, the regions contains the R_5 (J) *transitions of* ν_1 (a --> s) at 3450.8 and (s --> a) at 3452.5 cm^{-1}. Pairs of transitions with similar intensities (at 3451.5, 3451.9 and 3452.9, 3453.4 cm^{-1}) are the inversion doublets $^PQ_2$ (4) and $^PQ_2$ (3) of ν_3. Left panel : the calculation obtained by the present results (dashed lines) reproduces these features fairly well and improves the calculation obtained using HITRAN 96 prediction (dashed lines in the right panel).

Fig. 5. Comparison of the observed and computed spectra using Kitt Peak data recorded at 0.012 cm^{-1} resolution with a 1.5 m cell and a gas sample of $^{14}NH_3$ of 2.6 Torr at 295 K. The plot above the spectrum shows the differences between the observed and calculated spectral digits x 100.

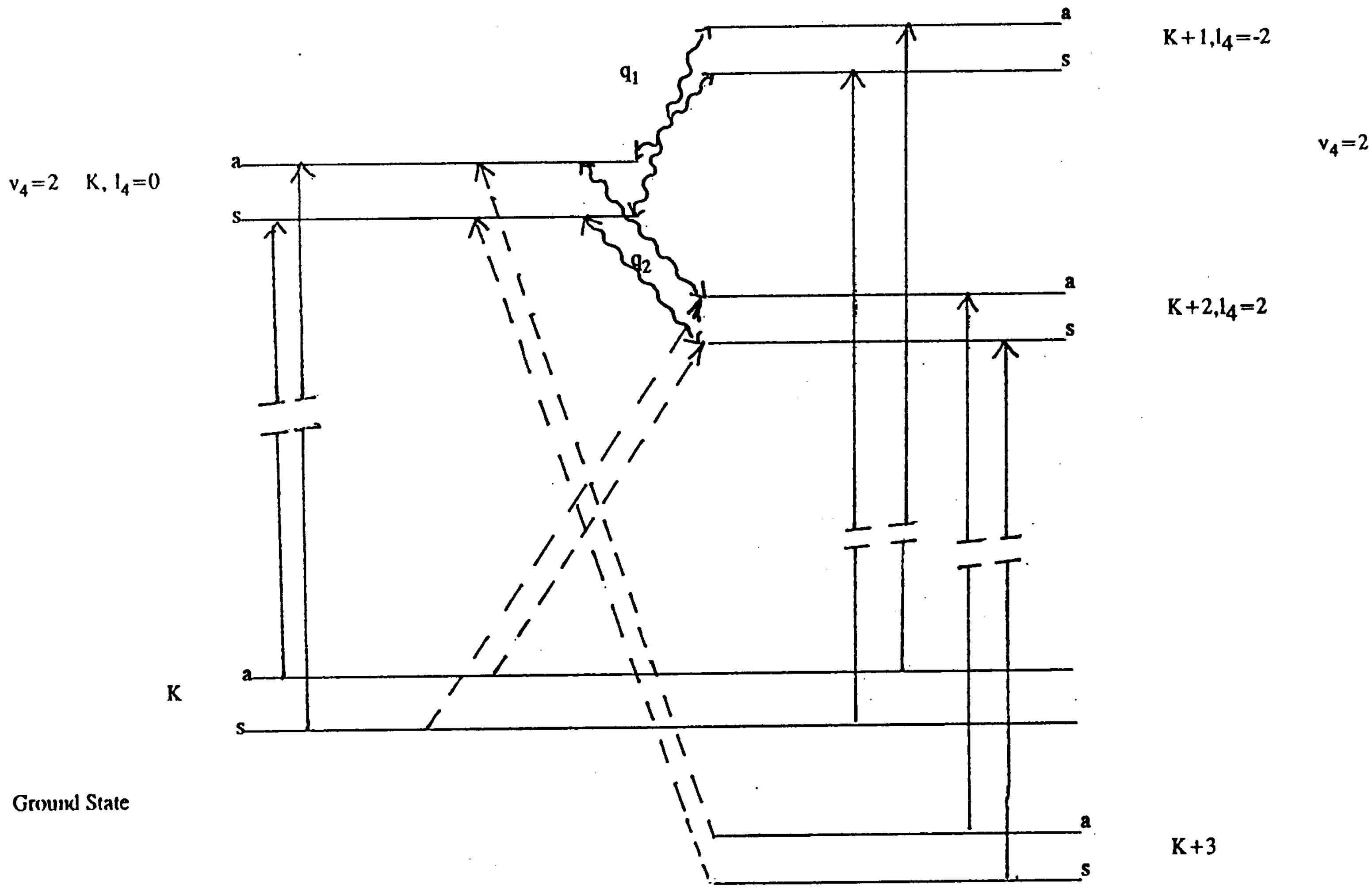
Bottom: near 3459 cm^{-1}, features are tentatively assigned to the $4\nu_2$ (s) band.



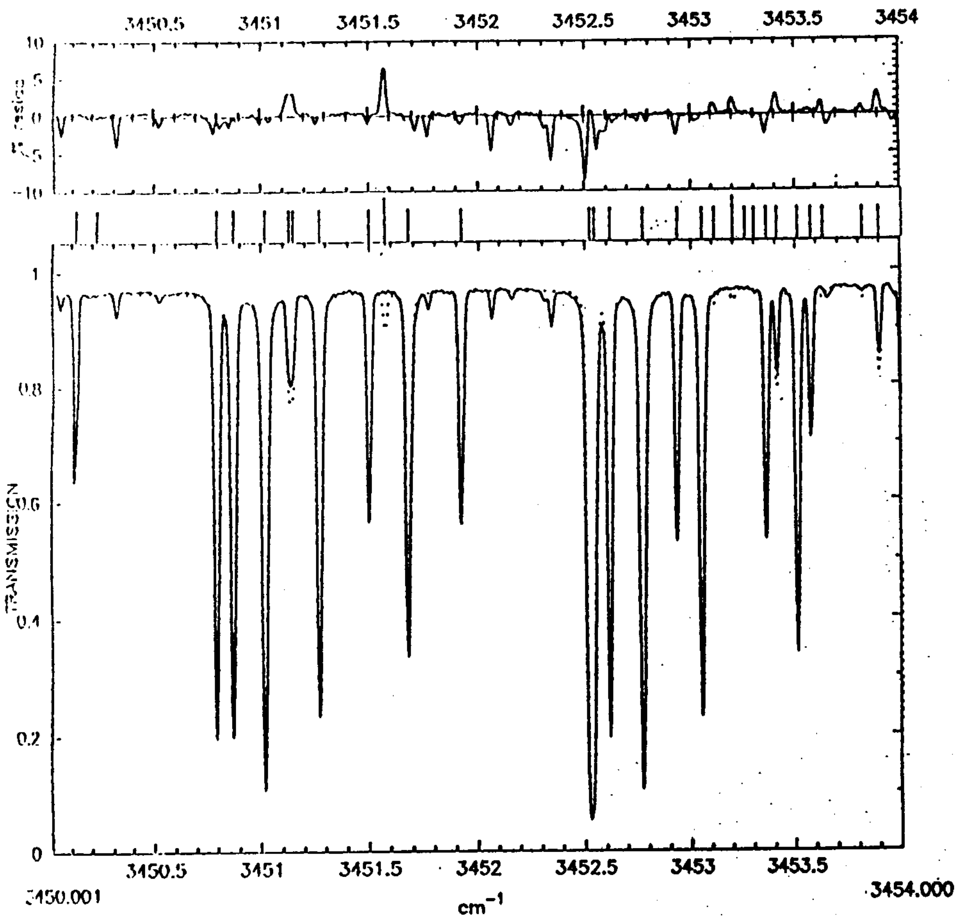
E/hc
(cm⁻¹)
4000
3800
3600
3400
3200
3000
a
$4\nu_2(A_1')$
s
a
$\nu_3(E')$s
a
$\nu_1(A_1')$ s
a
$2\nu_2+\nu_4(E')$
s
a
s
a
s
$2\nu_4(E')$
$2\nu_4(A_1')$



c_{21}
K
a
s
$v_1=1$
$q_{3v}(v_1)$
K+3
a
s
K
a
s
Ground State
a
s
K+2,l_3=-1
$q_{3v}(v_3)$
$v_3=1$
a
s
K+5,l_3=-1
a
s
K+3



$v_4=2$ K, $l_4=0$
a
s
a
s
K
Ground State
q_1
q_2
a
s
$K+1, l_4=-2$
$v_4=2$
a
s
$K+2, l_4=2$
a
s
$K+3$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% resids
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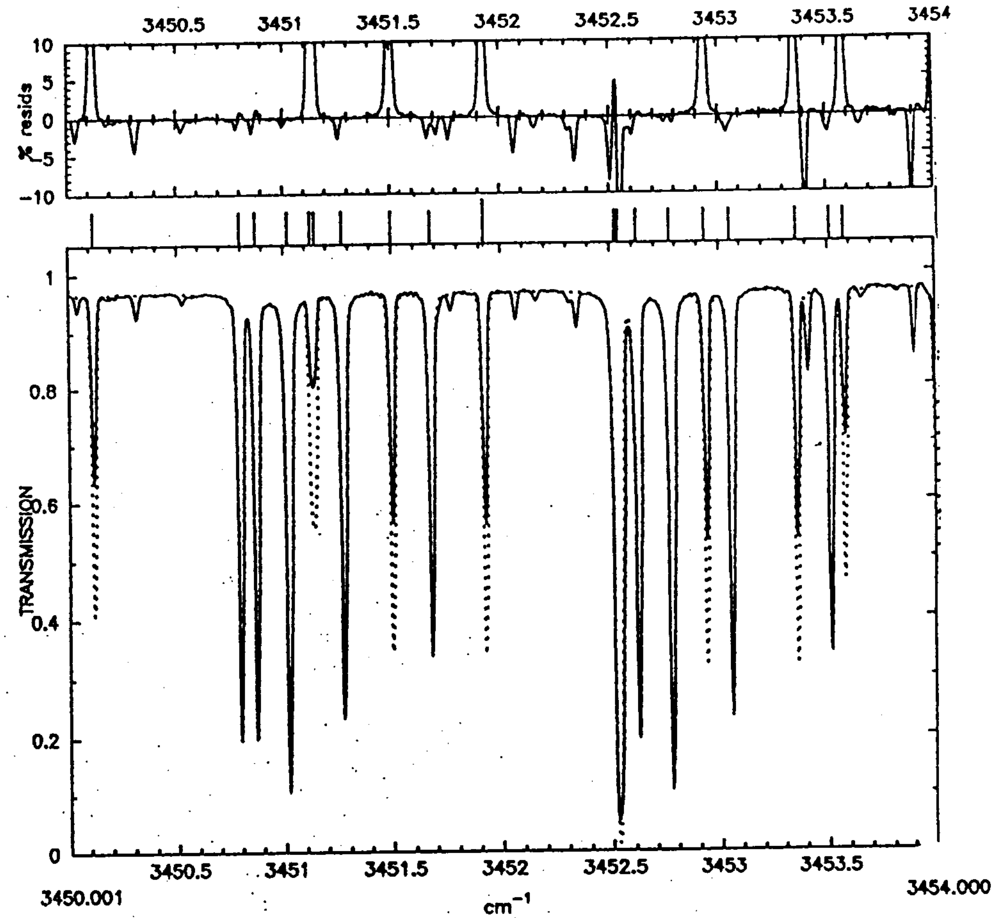
cm^{-1}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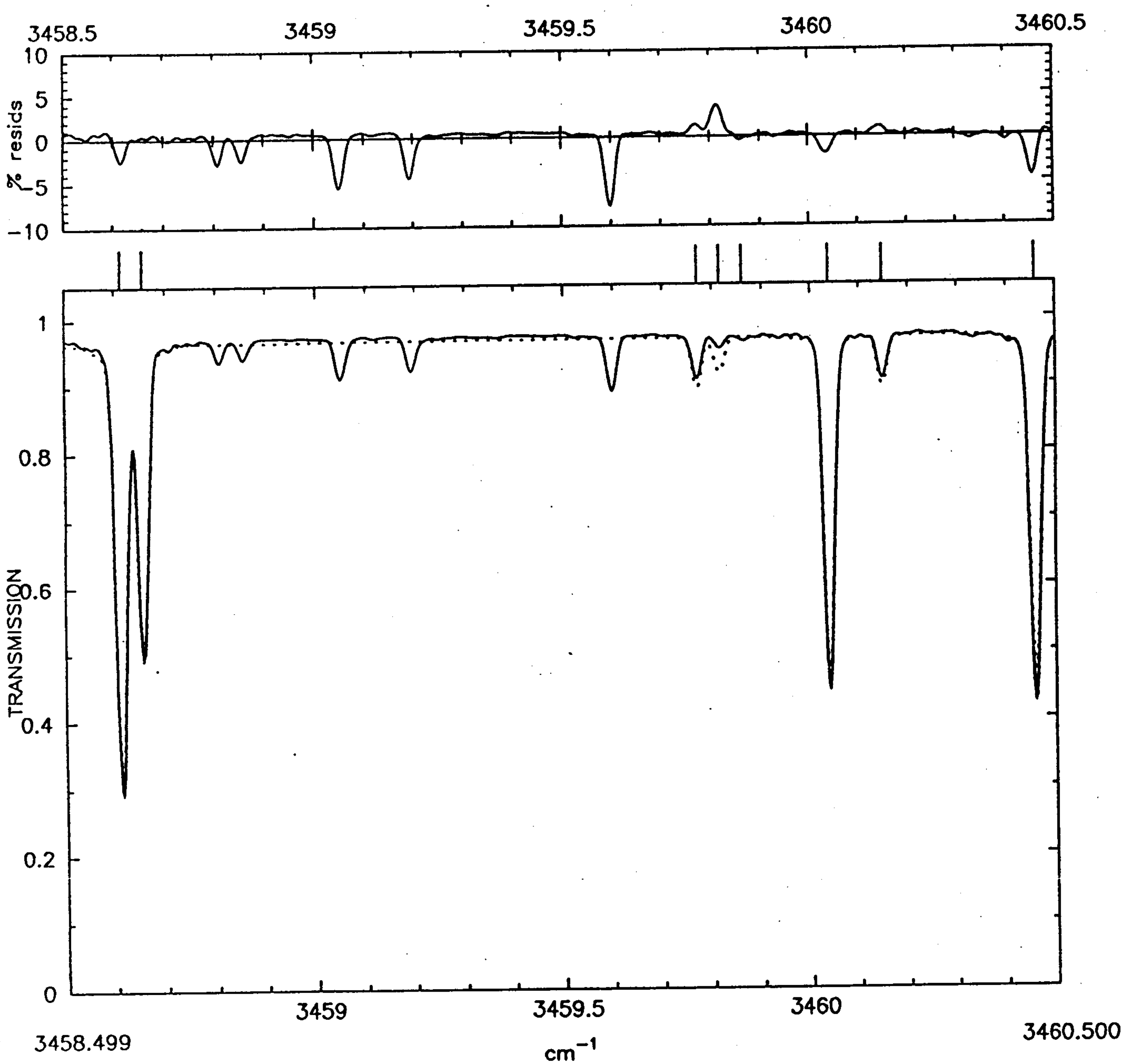
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-5
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% resids
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0.2
0
TRANSMISSION
3459
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3460
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3460.500
cm^{-1}